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AUSTRALIAN TREE FROGS OF THE GENUS *HYLA*.

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Synopsis.

All 44 known continental species and subspecies of the genus *Hyla* are dealt with in a purely systematic way, but an attempt has been made to indicate at least interesting and important notes on ecology, colour in life, breeding habits and other matters not directly bearing on the present approach. A standard description of each frog is given to facilitate comparison. It was thought essential to include original descriptions to serve as courts of appeal, especially as so many type specimens are unavailable overseas. Variation in nearly 3000 frogs has been studied, and contributions of other authors have been discussed. Fairly comprehensive lists of locality records are included as a basis for the more accurate study of geographical distribution. Short diagnoses have been added to the key to simplify identification. Eight new specific and subspecific names have been given.

INTRODUCTION.

The purpose of this paper is to provide a basis for work on the Australian tree frogs or Hylids. It was felt that this would be best served by providing a complete set of standard descriptions of all species so that comparison of species can be made conveniently and directly character by character. It has been thought essential to include all original descriptions. They must serve as the final checks because the ultimate court of appeal to type specimens cannot be made in Australia. Most types are overseas and it would be impossible in any case to trace many of them. To the standard and original descriptions have been added notes on variation based on the individual examination of nearly 3000 frogs from the collections of most museums in Australia and a fairly large number of specimens in the author's collection. Geographical distribution has been dealt with by lists. Finally, problems associated with each species and the contributions of other authors have been discussed. A short diagnosis of each species has been added to the key to facilitate identification. One reason for this work is that the Australian Hylidae lack any comprehensive paper dealing with them as a unit. All other Australian frogs have been monographed: the Ranidae by Boulenger (1920), and the Microhylidae and Leptodactylidae by Parker (1934, 1940). Keferstein (1868b) dealt with all species known at his time in the only work on Australian frogs to be published yet, but his descriptions are often short and other aspects are hardly mentioned. Also some frogs have the barest treatment. Boulenger in his great catalogue dealt with the frogs of the whole world (1882), and besides a standardized description was able to give only a short synonymy and the localities of but few specimens. Nieden (1923) in the main gave only a redescription from Boulenger, adding occasional points and including species new since that author. Loveridge (1935), who made an essential contribution to this study, listed all Hylidae known at the time, gave many locality records, and did much towards clearing up problems, notably those of the *lesueurii* and *ewingii* groups. It has been impossible to deal fully with even the more important references by the many authors who have discussed Australian Hylids, yet an attempt has been made to indicate briefly interesting and important notes on ecology, colour, breeding habits and other matters not directly bearing on the present systematic approach to all the continental species known. It is expected that some of these fields will be treated at length in forthcoming publications by Moore and Colefax. This study of variation and distribution has strongly suggested certain patterns of migration from the north. The picture is of at least three phases—one comparatively remote

leading to the colonization of Tasmania and south-west Australia by a path close to the southern coasts in wetter times; a second after the establishment of desert conditions isolating the south-west corner both from the north and east; and, finally, very recent minor waves of migration from New Guinea affecting Cape York peninsula. This last phase of colonization by frogs is paralleled in lizards, *vide* Copland (1946: 310). Noble's papers (1921: 1 and 1922: 63-75) should be consulted, but the subject cannot be surveyed here. While the present study has abundantly supported the comments by Cochran (1955: xv) that "Every physical character found in frogs varies to some extent, and some characters vary much more than others. These facts have not been fully realized by some authors. For instance, the position and development of the vomerine teeth, used by Boulenger, Cope, and other herpetologists, are not constant in some species. Key characters must therefore be interpreted rather widely, with the realization that no key will suffice for the identification of every individual in a variable species", variation must be regarded as occurring within well defined limits and the characters of Australian Hylids are for the most part conservative. The remarks of Wright and Wright (1949: 2) that "We have realized the inadequacy of vertebrae, skull, pectoral girdle, sacral diapophyses, teeth, disks, and other structural characters (largely osteological) in the classification of a smooth (scaleless) group" seem unduly pessimistic. The usual taxonomic terms have been adhered to with the following provisos. There is probably no satisfactory method of dealing with webbing because preservation alters its extent, but a method which allows comparison has been adopted. The web is gently expanded to its normal condition and its length measured in the midline from the junction of the enclosing digits. The digits are measured from the same point to the base of the discs. Then the length of the web is doubled and taken as a percentage of the combined lengths of the two digits. Comparative lengths of fingers and toes are given in order of increasing size, the smallest first. The size of the largest disc, usually that of the third finger and fourth toe, is used for discussion. The thumb is counted as the first finger. Some references have been omitted as not contributing anything of importance to the knowledge of hylids, and others have simply been mentioned under the heading of synonymy and references. References are normally given to the first page only on which a species is mentioned, but an exception has been made in the case of Fletcher and a few others where the references are widely scattered. Modern papers on systematics, including Parker (1934, 1940), Loveridge (1935, 1945, 1948), Liu (1947), Taylor (1948, 1949) and Neill (1954) have been consulted in drawing up the standard description. Particular care has been paid to include every diagnostic feature of the original description in the standard one. Usual abbreviations have been used for the States, and the following ones for museums: A.M., Australian Museum; Q.M., Queensland Museum; N.M., National Museum, Melbourne; S.M., South Australian Museum; W.M., Western Australian Museum; Q.V.M., Queen Victoria Museum, Launceston. R.D.M. and A.C. refer to the collections of R. D. MacKay and the author. Actual dates of collection are given when possible; if not, the date of acquisition. The bibliography has been made as complete and accurate as possible. I regret omissions and errors. The key is based on that of Boulenger and the Australian Museum manuscript one prepared by Fry and later revised by Kinghorn. Minor points have been noted from Kesterstein, Scott and others. Most of the common Australian frogs are treated briefly in Lucas and Le Souef's *The Animals of Australia*, but their treatment does not add greatly to the present study.

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points in discussions and lent me specimens. Miss G. L. Allpress, of the Linnean Society of New South Wales, and the librarians at the Australian Museum and the Royal Societies of New South Wales, Victoria and Tasmania kindly sought out references for me and lent books. I am indebted to Dr. H. W. Parker, of the British Museum, for sending me a copy of Tschudi's "Classification der Batrachier" otherwise unavailable in Australia. John M. Condit's manuscript check list of the Hylidae of the World has been very useful. General thanks are due to Professor John M. Moore, whose visit to Australia did so much to rouse interest in local frogs. I would also like to acknowledge help from Mr. F. J. Mitchell, of the South Australian Museum; Miss P. B. Atkins, of the Queen Victoria Museum; Mr. C. Tanner, Mr. Ross Pengilley and Miss Gabrielle Smith. Dr. W. G. Woolnough translated some German for me. The many authors discussed in the text are listed in the bibliography and synonymy. It is fitting to refer to the outstanding contributions to the knowledge of Australian amphibia made by Mr. J. J. Fletcher, who was for so long a prominent member of the Linnean Society of New South Wales. I am much indebted to Dr. A. B. Walkom for the thankless task of editing this paper. Lastly, I am grateful to my wife and daughters Morgen, Janet and Christina for either collecting or enabling me to collect many hundreds of frogs during collecting trips.

Key to the Hylidae of Australia.

(Several drafts of a dichotomous key have proved cumbersome and unsatisfactory. The clearest method for identification appears to be to use this method to divide the frogs into groups, and then to provide diagnoses within each group.)

A. Vomerine elevations absent.

1. Extremely slender, width of head contained in length of head and body 3.5 times, head wider than body in 93% of cases; snout projecting, rather shark-like; side stripe conspicuous; small granular disc in centre of tympanum *H. bicolor bicolor*.
2. More compact, body less elongated, width of head contained 3 times in length of head and body, body wider than head in 80% of cases; more extensive webbing between 3rd and 4th fingers; constriction of body between eye and shoulder less pronounced; tympanum smaller; white stripe from mouth to above shoulder more conspicuous *H. b. glauerti*.

AA. Vomerine elevations present.

B. Fingers at least one-third webbed.

1. A serrated ridge along hinder edge of forearm and foot; tympanum distinct, about 2/3 diameter of eye; vomerine elevations mainly between choanae; webbing reaches disc of 4th finger; toes entirely webbed *H. eucnemis*.
2. Vomerine elevations very small, oval, oblique, well separated from each other and choanae, totally or about 2/3 behind choanae; fingers strongly webbed; toes fully webbed; tympanum 1/3 or 1/4 size of eye; uniform plumbeous above, whitish below *H. dayi*.
3. Upper arm white and much thinner than forearm, which is widened and thickened into a large, granular, dorsal shield; tympanum covered with granular skin; often a white line from canthus rostralis, over eye, and above tympanum; thighs purple; granular area along margin of lower jaw; yellow or white below; finger webbing 70% *H. gracilentia*.
4. Resembles *gracilentia* but differs in larger size, larger eye, obtuse canthus rostralis, oblique lores, very distinct tympanum the skin of which is free from granulation, uniform head colour, and absence of white streak along limbs and round the upper surface of the head *H. chloris*.
5. Large size; blue in alcohol; skin of back thick and smooth with minute pores; often white spotted haphazardly on sides and back, only plain in about 30% of cases; usually white markings under tympanum, from angle of mouth, and on upper arm; largest finger disc averages size of tympanum; fingers webbed about 40%, toes 56% *H. caerulea caerulea*.
6. White spotting and other white markings less conspicuous; finger discs smaller than tympanum *H. c. gilleni*.
7. Habitus large and rangy; a wide, white line, continued from along margin of lower jaw, runs back to above forelimb where it ends abruptly; finger web 53%; webbing of toes 68% *H. infrafronata infrafronata*.
8. A conspicuous, quite wide, white stripe runs back from the upper jaw, over the shoulder, and is prolonged half-way along the side as a series of large, blob-like, partly confluent white spots; lacks light line along canthus rostralis and behind eye as well as dorsal shield on forearm of *gracilentia*; white spots quite unlike those of *caerulea*

- in both distribution and character; tympanum distinct; skin smooth but minutely pitted; vomerine elevations almost behind choanae; finger webbing 33%, of toes 50% *H. irrorata*.
9. Vomerine elevations mainly between and in front of choanae, but because choanae are small they may project a little behind; posterior surfaces of thighs yellow more or less boldly blotched with black; dorsum rough and always more or less warty; webbing of fingers 50%; toes webbed to discs or nearly so *H. peronii*.
10. Unlike *peronii* perfectly plain behind thighs except for a small dark extension from dorsum about vent; groin immaculate or with a few, very small, obscure white spots; habit moderately slender; head longer than broad; finger webbing 24%, of toes 70% *H. burrowsi*.

BB. Fingers free or webbed at the base.

C. Vomerine elevations behind the level of the choanae, or only slightly between.

1. A gold or white line along the canthus rostralis and supratympanic ridge always present; front of thighs and practically whole of posterior surfaces purplish or colour of squashed mulberry, occasionally white or yellow; tympanum half size of eye, often indistinct; vomerine elevations very small, rounded, narrowly separated, entirely behind choanae; web of fingers 23%, of toes 63%; dorsum uniform bluish green *H. phyllochroa phyllochroa*.
2. Dorsum punctate with a varying number of jet black dots; snout projecting; eye bulges very distinct; vomerine elevations about half between choanae *H. p. barringtonensis*.
3. Vomerine elevations totally behind choanae very distinctly to only just, except in 5% when they are partly between the choanae; finger discs equal tympanum or are slightly smaller; small webs between fingers; backs plain, flecked or dotted, or banded but not in a trilobed fashion *H. rubella*.
4. A wide, dark, median band the whole length of head and body, covers more than half the back and is composed of three more or less equally sized rounded areas marked off by waists to form a trilobed pattern; dorsal colours light brown and dark brown; vomerine elevations totally behind choanae *H. dentata*.
5. Vomerine elevations in two oblique or rounded groups almost always behind the choanae; a distinct white line from under the eye becomes more pronounced, although broken up, over glandular area behind mouth; fingers free or web moderately developed; toes half webbed; discs smaller than tympanum; heel reaches to about tip of snout ... *H. citropa*.
6. Upper surface of body minutely pitted so that the closely opposed margins present a finely reticulate appearance; tympanum not visible; toes completely webbed; olive grey back blotched with dark markings *H. maculata*.
7. Tympanum hidden or very small, about 1/4 or 1/3 diameter of the eye, rather indistinct; vomerine elevations nearly half between choanae; dorsal colour uniform brown with obscure dark marbling *H. obsoleta nannotis*.

CC. Vomerine elevations between, or on a level with the front edge of the choanae.

D. No outer metatarsal tubercle.

E. Toes half to two-thirds webbed.

1. A wide blackish bar joins the eyelids and extends as a wide black band to the end of the body, it is divided by a vertebral light stripe; a conspicuous white or silver stripe from under the eye to over the shoulder; sides light brown with obscure dark markings; posterior surfaces of thighs clear yellow (red in life) except for a few indistinct brown spots *H. ewingii ewingii*.
2. The wide dorsal band, vertebral light stripe and habitus of *e. ewingii* retained; prominent black blotches on sides; snout shorter and tip more truncate than in *e. verreauxii* *H. e. iuxtaewingii*.
3. Prominent black blotches on sides; back of thighs plain yellowish or with speckling or obscure markings; snout rather pointed; discs of fingers from half to as much as three-quarter size of tympanum; fingers free or webbed as much as 20% *H. e. verreauxii*.
4. Back and sides very warty; generally heavily striped longitudinally with black; a black oblique bar down the flank; usually a wide and distinct light vertebral line; a white band from over the eye joins one from under the eye over the shoulder to enclose a prominent black stripe from the nostril to over the shoulder; posterior surfaces of thighs generally clear yellow or brownish; fingers free with small discs; almost always green in life *H. e. alpina*.
5. Markings as *alpina*, but back smooth or practically so; markings sometimes conspicuous, but even when reduced the oblique bar or heavy marking on the flank is almost invariably present; anterior and posterior surfaces of the thighs nearly always clear yellow, but there may be a few black dots *H. e. loveridgei*.

6. Groin and hinder side of thigh with bold, accentuated, rounded, purple or black blotches on light brown or yellow; finger discs as large as tympanum or even larger; webbing of fingers better developed than in other races except a few *verreauxii* *H. e. calliscelis*.
 7. Tympanum very small, 1/3 diameter of eye; vomerine elevations very small (probably *ewingii*) *H. parvidens*.
 8. Compact habitus; heel reaches to centre of eye; large black markings on back of thigh and flank; rather large tympanum; wide interorbital space; dorsal band lacking *H. inguinalis*.
- EE. Toes more than two-thirds webbed, the web reaching the discs of the 3rd and 5th toes, or practically so.
1. Hinder side of thighs yellow; larger than *ewingii*; more elongated and at the same time the body is more flattened and the head is wider *H. jervisiensis*.
 2. Snout elongate, pointed, shark-like in profile; a little webbing between 2nd and 3rd fingers; vomerine elevations between or to half behind choanae; a wide, white line from the upper lip to above the shoulder is occasionally extended more posteriorly *H. adelaidensis*.
 3. Fingers quite free; snout considerably longer than the diameter of the eye; dorsum practically smooth; no vertebral white stripe; a continuous dorsolateral fold; a white line along dorsolateral fold from eye, and another from under tympanum to above shoulder *H. aurea aurea*.
 4. A distinct white vertebral line; back warty, especially from behind head to end of body; the dorsolateral fold usually discontinuous and posteriorly broken up into a series of warts; warts often arranged in four or six irregular longitudinal rows along back *H. a. raniformis*.
 5. Close to *raniformis* and its Tasmanian representative. Larger than *raniformis*, of which only about 6% are over 60 mm. and 1% over 70 mm., the Tasmanian race has about 75% of adults over 60 mm. *H. a. major*.
 6. Lacks the prominent white dorsolateral line and also the line along the upper jaw; back quite smooth; vomerine elevations in a single series; underside uniformly white *H. a. ulongae*.
 7. Canthus rostralis more sharply marked than *aurea*, nostril twice as far from eye as from end of snout, 1st finger longer than 2nd, 3/4 instead of nearly entirely webbed toes (*vide* Procter 1924: 1128) *H. blandsuttoni*.
 8. Skin more or less shagreened (only one smooth example seen); usually more warty than any *aurea*; normally two phases of warts, one large and the other smaller; larger size than *raniformis* *H. moorei*.
 9. Groin and sides of thighs black, with large, rounded, white or yellow spots; lower surfaces reticulated more or less strikingly with black in adults; dorsum generally considerably warty enclosing a narrow, smooth vertebral area; snout rounded; vomerine elevations between choanae; back usually grey with dark, irregularly rounded islands *H. cyclophrychus*.
- DD. A small outer metatarsal tubercle.
- E. Finger discs nearly size of tympanum, webbing of fingers about 10%.
1. Vomerine elevations paired, transverse, widely separated; on line joining anterior corners of choanae; posterior surfaces of thighs light brown with a dark brown and light grey mottled patch below vent; outer metatarsal tubercle small but distinct; heel reaches in advance of snout; webbing of toes about 60% *H. X Moore*.
- EE. Discs of fingers and toes very small, fingers free of web.
- F. Back smooth or with a few low indistinct warts.
1. Hinder side of thighs with typically a large black plate, marbled with white islands, ocelli, figures of eight and similar enclosed areas or script-like markings; generally olive or brown above, plain or peppered with black; eye bulges prominent; the distance from the anterior corner of the eye to the tip of the snout is usually less, rarely equal, to the distance between the anterior corners of the eyes *H. lesueurii*.
 2. Posterior surfaces of the thighs usually boldly marked with black or dark brown on a yellow or yellowish-white ground; a marbled and reticulated pattern running back from between the eyes is distinctive when present; a slimmer species than *lesueurii* with a narrower head, the distance between the anterior corner of the eyes and the snout is equal to or longer than the distance between the anterior corners of the eyes; eye bulges are flattened and the upper eyelids are warty *H. latopal mata latopal mata*.
 3. Snout longer and more pointed than in *l. latopal mata*, the distance between the anterior corner of the eye and the tip of the snout is about a fifth more than that between the anterior corners of the eyes; the dorsal pattern of *l. latopal mata* does not occur; the posterior surfaces of the thighs are marked with black on white or grey, not yellow *H. l. watjulumensis*.

4. Posterior surfaces of thighs plain yellowish-white; a small marbled area confined to the dorsal surface of the thigh; dorsum light brown closely spotted and reticulated with darker brown; upper eyelids reticulated in black and white; a wide, flattened body with a very wide head tapering to a narrow waist; vomerine elevations widely separated and more than half behind line joining the posterior borders of the choanae *H. jenolanensis*.
 5. Very close to *latopalmata*, but upper jaw less pointed and lower jaw almost semi-circular; dorsum quite smooth without even wartiness of upper eyelids; vomerine elevations transverse and closely opposed instead of being well separated; the black pattern behind the thighs is on grey not yellow; no short dark bars on lower jaw *H. kinghorni*.
- FF. Back with very prominent warts, or plaits, or longitudinal folds of skin.
1. Back with prominent longitudinal skin folds and striped with light and dark brown or black; hinder side of thigh yellowish with a dark stripe running its whole length a little towards the dorsal margin, often a second or even a third longitudinal stripe; the most beautifully streamlined of all Australian frogs with its long head and pointed snout *H. nasuta*.
 2. Back conspicuously warty without extended folds, warts rounded, generally separate, rarely confluent; colour of back variegated; posterior surfaces of thighs brown (more or less dark) with a few irregular white or light spots *H. freycineti*.

HYLA BICOLOR BICOLOR (Gray).*

Synonymy and references.—*Eucnemis bicolor*: Gray (1842: 57); Günther (1867: 55). *Hyperolius ?bicolor*: Günther (1858: 89). *Hyperolius bicolor*: Krefft (1865: 20); Keferstein (1868b: 275). *Hylomantis fallax*: Peters (1880: 224), vide Nieden (1923: 208). *Hylella bicolor*: Boulenger (1882: 421); Fletcher (1889: 360; 1894: 526; 1898: 682, 684); Andersson (1916: 20). *Hyla bicolor*: Kampen (1906: 173; 1923: 26-7, 44); Roux (1910: 33); Nieden (1923: 208); Loveridge (1935: 41; 1948: 399); Mitchell (1955: 405).

Gray's original description (1842: 57) reads: *Eucnemis bicolor*. Blue in spirits; underside of body and limbs bluish white; the lips, chin and a streak from under the eye, beneath the tympanum and along the side of the body to the groin, pure white; back smooth; belly and thighs granular: the fore toes scarcely webbed, the hinder ones webbed to the end; the toe disks small: tympanum distinct. Agrees with the variety of *Hyla Jacksoniensis* in the disposition of the colours. Inhabits north coast of Australia; Port Essington, Mr. Gilbert.

Description of No. R.11623, in the Western Australian Museum, a young male, Watjulum Mission, north-west Western Australia:

Habitus very slender; the greatest width, between eye and tympanum, contained about 3.5 times in the total length of head and body (26 mm.); head triangular, somewhat longer than broad (8.5 × 7.5 mm.); snout moderate (4 mm.), 1.5 times diameter of eye (2.75 mm.), rather pointed when seen from above, very slightly rounded but almost straight in profile, strongly projecting so that the nostril is a little in advance of lower lip; canthus rostralis angular and distinct, slightly curved; lores a trifle concave, almost vertical; interorbital width a little greater than that of an upper eyelid (2.5 to 2 mm.), the top of the head flat between rather prominent eye bulges; internasal space 2.25 mm.; diameter of the eye equals its distance from nostril; tympanum moderately distinct, although granular especially in centre, almost vertical, contained in diameter of eye about 1.4 times (2 to 2.75 mm.), distance from eye 1 mm.; supratympanic fold extremely small; seen from above the body is constricted by a long, concave area between the eye and shoulder on each side.

Skin smooth above; chin and throat smooth; body and underside of thighs with small area up to vent granular; otherwise limbs smooth; two pectoral folds, one on each side of the girdle; anal flap small but distinct.

Forelimb fairly robust and long (13 mm.), half length of head and body; hand 5.5 mm.; a widened flat shield on the forearm; finger discs wider than long, small, half size of tympanum (1 to 2 mm.); fingers in order of length, 1, 2, 4, 3, 4th practically equal to 3rd; the merest rudiment of web, except between 3rd and 4th fingers where it amounts to about 20%; no fringes; subarticular tubercles indistinct; palm granular; thumb slightly widened at base.

* An index to the species and subspecies dealt with appears at the end of the Address.

Hindlimb robust for length (42 mm.), 162% of head and body; femur 13 mm., tibia 13 mm., foot 16 mm.; heel reaches to tip of snout; toe discs small but distinct, rounded or slightly widened, not much more than one-third diameter of tympanum (0.75 to 2 mm.); toes in order of length, 1, 2, 3 = 5, 4; extent of webbing between toes, 44, 67, 87 and 73%; web to disc of 5th toe; toes fringed; subarticular tubercles small and indistinct; sole smooth but divided; inner metatarsal tubercle distinct, slightly elongated; no outer one.

No vomerine elevations; tongue rather narrow, truncate, free and nicked behind, grooved dorsally; a rather small subgular vocal sac with large transverse openings into the mouth on each side of the tongue.

Dorsum and dorsal surface of tibia blue with indications of brown, the same colour but less marked on the thighs as a narrow band and on shield on forearm; all dorsal surfaces especially limbs peppered with multitudes of tiny dark brown dots; a conspicuous black band runs from the tip of the snout to the eye, being most marked under the canthus rostralis; this band continues behind the eye over the tympanum to nearly half-way along the side where it becomes an ill-defined brownish stripe as far as the groin; the area about the tympanum is brown with little dots which continue back under the black stripe; under this more or less double stripe, a prominent white stripe runs from the tip of the snout to the groin; ventral surfaces and upper arms are pale yellow; the posterior surfaces of the thighs are also pale yellow, immaculate proximally but heavy dark dotting gradually becomes more distinct distally to form a kind of longitudinal stripe.

Specimens examined and Locality Records: 15 (R.11623-32, R.11959, W.M.) Watjulum Mission, north-west W.A.; 2 (R.1520, A.M.) Cooktown, Q. (D. le Souef), 27.xii.1893; 4 (R.4535, A.M.) Somerset, Cape York, Q. (Hedley and McCulloch), June, 1909; 4 (R.6655, A.M.) Herbert River, North Q. (T. Steel), 14.iv.1914; 6 (R.6944, A.M.) Townsville, Q. (F. H. Taylor), 15.iii.1916; 10 (R.9591, A.M.) Cape York, Q. (Mel Ward), 1928; 2 (R.12425, A.M.) Echo I., off Arnhem Land, N.T. (C. Barrett), 20.ii.1940; 1 (R.12896, A.M.) Darwin, N.T. (T. R. Tovell), 23.iii.1945; 8 (M.C.Z.25996-7) Knuckey's Lagoon, 9 m. S. of Darwin, N.T. (T. R. Tovell), 1944, also two New Guinea localities, vide Loveridge (1948: 399); 3 (U.S.N.M.128712-4) Oenpelli, N.T.; 19 (U.S.N.M.128686-703; R.3251, S.M.) Cahill's Landing, East Alligator River, N.T.; 2 (U.S.N.M.128710-1) Red Lily Lagoon, N.T., last three references vide Mitchell (1955: 405), last two localities about 6 m. W. of Oenpelli, N.T.; 1 (M.C.Z.18489) Bellenden Ker Range, Q. (W. E. Schevill), vide Loveridge (1935: 41); Port Essington, N.T., type locality, vide Gray (1842: 57); Cape York, Q., vide Günther (1867: 55); Alice River and Cape York, both Q., vide Andersson (1916: 20).

All 44 specimens in the Australian and Western Australian Museums have been examined.

Variation.—The snout is strongly projecting and shark-like in profile in all except one of the Watjulum specimens. The interorbital width is constantly greater than that of an upper eyelid, and often approximately twice as wide. The tympanum is consistent in being contained in the diameter of the eye about 1.4 times. The granular area in most frogs is concentrated to form a small disc in the centre of the tympanum. The well-marked constriction between the eye and shoulder is always present. The shield on the forearm is always developed and has a dorsal pleat, which may be very distinct, across the wrist. Fingers are practically without web except for about 20% between the 3rd and 4th. Webbing of the toes agrees very well with that of R.11623. It is generally well separated from the disc of the 3rd toe, but very close in one or two specimens. Coloration is fairly typical. The stripe through the tympanum is usually brown but may be practically black. The dark stripe behind the thighs may extend the whole length, be represented by an area of dots, or even in one case be nearly plain. A few specimens have the dorsum brown. The 10 R.9591 juveniles show the side stripe just as clearly as adults.

Discussion.—*H. b. bicolor* is chiefly distinguished because of its extreme slenderness. The width of the head is contained on an average 3.52 times in the total length of head and body as compared with 3.07 times for *b. glauerti*. The slender habitus is still

further emphasized by the fact that only about 7% have the body wider than the head while this occurs in about 80% of *glauerti*. One specimen of *bicolor* R.11632 had the head width to snout-vent measurement as low as much as a third. *Bicolor* also differs in the following respects from *glauerti*: the snout projects more, the tympanum is slightly larger, the constriction between the eye and the shoulder is more pronounced, and the side stripe is more prominent. *Glauerti* has more extensive webbing between the 3rd and 4th fingers, a wider and more conspicuous stripe from above the mouth to the shoulder, and a larger external vocal sac in the males. Andersson (1916: 20) had eight specimens which all lacked vomerine teeth. He records that Dr. Mjöberg reported the frog as very common in pandanus trees, where they sat in the interspaces of the leaf sheaths. A field note with the fine series from Watjulum remarks that specimens only occurred on pandanus. Nieden (1923: 208) describes *bicolor* both with and without vomerine elevations. He gives a full account of the tadpole. Noble (1931: 508) sank *Hylella* and *Nyctimystes* as polyphyletic assemblages in *Hyla*. Loveridge (1935: 41) noted that his two alcohol-preserved frogs were smooth above, even under a strong lens, while a formalin-preserved specimen was strongly granular. Later (1948: 399) he discusses eight frogs from the Northern Territory and 49 from Merauke and Aitape. The New Guinea group "apparently only differ in the possession of vomerine teeth and larger size". The largest male and female each measured 30 mm. Twenty-two Aitape juveniles had no vomerine elevations. New Guinea frogs should probably be given subspecific status if only on the grounds of the adults possessing vomerine elevations. *Bicolor* occurs along the northern coasts of Australia and then down the eastern seaboard to about Central Queensland, where it is replaced by *glauerti*. Its range also includes islands off the northern coast and New Guinea.

HYLA BICOLOR GLAUERTI, subsp. nov.

Synonymy and references: *Eucnemis bicolor*: Günther (1867: 55). *Hyperolius bicolor*: Krefft (1865: 20). *Hylella bicolor*: Boulenger (1882: 421); Fletcher (1889: 360, 386; 1890: 671; 1892: 11; 1894: 524-6, 530-1); Lucas and Le Souef (1909: 297). *Hyla bicolor*: Nieden (1923: 208); Loveridge (1935: 41).

Description of Type. No. A.C.124, an adult male, Colo, near Sydney, N.S.W., 18.ix.1938.

Habitus moderately elongated but a compact little frog, total length of head and body 24 mm.; head triangular, very slightly longer than broad (7.5×7 mm.); snout moderate (4 mm.). 1.6 times diameter of eye (2.5 mm.), obtusely pointed when seen from above, rounded in profile, extending slightly beyond lower lip; canthus rostralis curved horizontally, rounded but distinct; lores rather erect, mildly concave; inter-orbital width about twice that of an upper eyelid (3 to 1.5 mm.), top of the head flat between prominent eye bulges; internasal space 2.5 mm.; diameter of the eye a shade more than its distance from nostril; tympanum quite distinct although its upper margin tends to merge with the general surface, nearly vertical, small, contained in diameter of eye twice (1.25 to 2.5 mm.); supratympanic fold negligible.

Skin smooth above; chin and throat smooth; belly and ventral surfaces of thighs uniformly and coarsely granulate; otherwise limbs smooth; the very prominent pectoral fold is the posterior border of the vocal sac; a narrow wide anal flap.

Forelimb robust, with forearm broadened, and fairly long (13 mm.), 54% of length of head and body; hand 5.5 mm.; finger discs distinct, slightly wider than long, a little smaller than tympanum (1 to 1.25 mm.); fingers in order of length, 1, 2, 4, 3, the thumb stands out practically at right angles to the 2nd; there is only a rudiment of web between the first three fingers, but that between the 3rd and 4th is extensive, amounting to 44%; practically no fringing; subarticular tubercles distinct, low, rounded; palm granular; thumb moderately expanded at base and with a black preaxial nuptial patch.

Hindlimb fairly robust and long, length (37.5 mm.) 156% of head and body; femur 11 mm., tibia 11 mm., foot 15.5 mm.; heel reaches to the nostril; toe discs small but distinct, wider than long, about equal to those of fingers, slightly smaller than tympanum (1 to 1.25 mm.); toes in order of length, 1, 2, 3 = 5, 4; extent of webbing between toes, 67, 67, 60 and 78%; practically no fringing; subarticular tubercles very small but

distinct; sole fairly smooth; inner metatarsal tubercle oval, moderately prominent, outer low, flattened and well in from margin of foot.

Vomerine elevations absent; choanae roundish and well separated at sides of mouth; tongue subcircular, free and flattened behind, about half width of mouth at angle of jaws; a large external subgular vocal sac, plicated, ending at the strong pectoral fold and with a large opening into the mouth at each side of the tongue.

Dorsal colour bluish in alcohol with faint brownish markings on the limbs; chin and throat powdered with tiny brown dots; belly and under surfaces of thighs yellowish; a prominent, wide, ivory-white line from under eye and tympanum to above forelimb, where it is interrupted, but it again continues to at least half-way along the side.

Specimens examined and Locality Records: 6 (R.4252, A.M.) Warrell Creek, Nambucca River, N.S.W. (Dene Fry), Nov., 1908; 1 (R.4479, A.M.) Seven Hills, Parramatta, N.S.W. (E. C. Ross), May, 1909; 1 (R.4635, A.M.) Nambucca River, N.S.W. (W. R. Clarke); 2 (R.4636, A.M.) Warrell Creek, Nambucca River, N.S.W. (W. Clarke), Jan., 1910; 7 (R.4671-2, A.M.) Clyde, near Sydney, N.S.W. (D. B. Fry), Feb., 1910; 1 (R.5083, A.M.) Richmond River, N.S.W. (R. J. Thorpe), Dec., 1910; 7 (R.5514, A.M.), Brisbane, Q. (Queensland Mus.); 3 (R.5866, A.M.), Brisbane, Q. (McCulloch and Troughton), Sept., 1912; 1 (R.5921, A.M.) Eidsvold, Q. (T. L. Bancroft), Sept., 1912; 1 (R.6114, A.M.), Eidsvold, Burnett River, Q. (T. L. Bancroft); 3 (R.6185, A.M.) Gurravembi, near Macksville, N.S.W. (D. B. Fry), May, 1913; 4 (R.6318, R.6320, A.M.) Gurravembi, N.S.W. (D. B. Fry and H. E. Smart), Oct., 1913; 2 (R.7975-6, A.M.) Upper Colo, via Richmond, N.S.W. (Kinghorn, Fletcher and Wright), Oct., 1922; 3 (R.8095, A.M.) Bulahdelah, N.S.W. (H. L. Kesteven), 18.viii.1923; 2 (R.8856-7, A.M.) Ocean Beach, Woy Woy, N.S.W. (T. G. Campbell), 7.x.1925; 1 (R.8942, A.M.) Mt. Tambourine, Q. (G. P. Whitley), Jan., 1926; 3 (R.10534, A.M.) Tuggerah, N.S.W. (R. Evans), Feb., 1932; 1 (R.10574, A.M.) Barolin Stn., Bundaberg, Q. (H. I. Innes); 1 (R.10773, A.M.) Capertee, N.S.W. (K. C. McKeown), Nov., 1932; 2 (R.12493, A.M.) N.S.W. (I. Mackerras); 1 (J.645, Q.M.) Eidsvold, Q.; 1 (J.2772, Q.M.) Kilcoy, Q.; 2 (J.6733-4, Q.M.) Emu Park, Q.; 1 (J.9527, Q.M.) Brisbane, Q.; 7 (A.C.30-4, A.C.37-8) Kilbride, near Campbelltown, N.S.W., 22.viii.1938; 1 (A.C.124) Colo, near Sydney, N.S.W., 18.ix.1938; 1 (A.C.164) Razorback Mt., near Picton, N.S.W., 16.x.1938; 17 (A.C.238-9, 241-51, 253, 255-7) 10 m. N. of Raymond Terrace, N.S.W., 27.xii.1938; 1 (A.C.4011) 15 m. W. of Karara, Q., 11.i.1949; 1 (A.C.4251) Failford, near Tuncurry, N.S.W., 14.i.1949; 3 (A.C.6102-3 and 7410, A.M.) no data; 2 (M.C.Z.3625-6) Nambucca, N.S.W. (Australian Mus.), 1914, vide Loveridge (1935: 41); Brisbane, Q.; Blue Mountains, N.S.W.; Port Denison, Q., vide Günther 1867: 55; Maclean on the Lower Clarence, N.S.W. (A. S. Olliff); Ulmarra to Chatsworth on the Lower Clarence (A. Lea); Armidale or Tamworth, N.S.W. (A. Lea), vide Fletcher (see synonymy).

All 88 specimens in the Australian and Queensland Museums and the author's collection have been examined.

Variation.—The large series of 88 specimens examined shows remarkably little variation. Vomerine elevations are always absent. Coloration is typical in all except for an odd frog which has a few black specks on the dorsum and one of the three R.6185 which has the throat speckled with black. The ivory stripe is often very wide and distinct to above the forelimb. In some cases this white stripe does not extend far back as such but merges into the white of the sides. Occasionally the dorsal blue of the spirit specimen extends down and forms a wide margin round the lower jaw. The black line along the canthus rostralis is generally prominent. A raised shield on the forearm forms a free flap over the wrist. The blue of the forearm spreads onto the dorsal side of the upper arm, which remains stout. The frogs are normally small, but a few reach 24 mm. and R.6318 from Gurravembi is by far the largest specimen seen at 32 mm.

Discussion.—Differences between the typical race and that living to the south-east were not realized until the Watjulum series of *bicolor* from the extreme north-west corner of Australia was compared with N.S.W. individuals. It then became necessary to find a new name for the frogs for so long regarded as typical *bicolor*. This elegant little frog with its two subspecies stands apart from other Australian Hylids. Fletcher

(see synonymy) deals mainly with distribution. He notes its discontinuous range, but says that where it does occur it is common. *Glauerti* ranges along the coast from Central Queensland to at least as far as Razorback Mountain, about 50 miles south of Sydney. Records from Capertee, Armidale or Tamworth, Karara and Eidsvold show that it may leave the coast a little and form colonies on the tablelands. Krefft (1865: 20) gives some interesting notes on habitat and distribution. He says of the eastern form "at first sight they look exactly like the young of *Hyla aurea*, but the absence of vomerine teeth, and the delicate light green colour upon the back, and pale orange between the legs, soon determine its true character".

HYLA EUCNEMIS Lönnberg.

Synonymy: *Hyla eucnemis* Lönnberg (1900: 579); Loveridge (1935: 40). *Hyla serrata* Andersson (1916: 17); Kampen (1923: 24, 32).

Lönnberg's original description (1900: 579) reads: *Hyla eucnemis*, sp. n. Tongue broadly heart-shaped, nicked and free behind. Vomerine teeth in two large but confluent groups, behind the level of the choanae, which are large, but not quite so large as the patches of vomerine teeth. Head large, about as broad as long. Snout subtriangular, the tip truncate, longer than the diameter of the orbit; canthus rostralis very distinct, curved; loreal region concave. Interorbital space broader than the upper eyelid. Tympanum distinct, about two-thirds the diameter of the eye. A glandular fold extending from the eye backwards above the tympanum. Three outer fingers extensively webbed, the membrane reaching the disks of the second and fourth; disks about the same size as the tympanum; toes entirely webbed; subarticular tubercles well developed. The hind limb being carried forward, the tibio-tarsal articulation reaches just beyond the eye. Upper surfaces of body and head very minutely granulate; belly and lower surfaces of thighs coarsely granulate. Throat covered with scattered warts; a series of similar warts along the margin of the lower jaw. A well-developed denticulated fringe along the outer side of the forearm and the outer finger; a similar fringe along the outer side of the tarsus and the outer toe. Heel with a triangular dermal appendage; some smaller dermal flaps near the vent. Colour (in spirit) dark plum above, uniform, with the exception of some very indistinct cross-bands on the hind legs; light below. The largest specimen measures 67 millim. from snout to vent.

Two specimens from Sattelberg.

With regard to the great development of the web between the fingers, this species resembles *Hyla gracilentia*, Ptrs., but differs from it in so many characteristics that there can hardly be any close relationship between them.

Description of No. R.10919, in the Australian Museum, Mt. Spurgeon, Q., 4000 ft. (M.C.Z.), May, 1933:

Habitus sturdy but not thick-set, width of body (26 mm.) 37% of total length of head and body (70 mm.); head almost semicircular, about as broad as long (26 to 25 mm.); snout moderate (12 mm.), 1.7 times diameter of eye (7 mm.), bluntly pointed when viewed from above, rounded in profile, nostrils directly above or perhaps a trifle in front of lower lip; canthus rostralis curved, distinct, slightly rounded; lores distinctly concave, the groove behind nostrils making them stand out prominently; interorbital width about one and a half times that of an upper eyelid (8 to 5 mm.), but the top of the head has been flattened and the demarcation is not very distinct; internasal space 6.5 mm.; diameter of eye exactly equals its distance from nostril; tympanum very distinct, directed slightly upward, contained in diameter of eye 1.6 times, distance from eye 3 mm.; supratympanic fold rounded and low but distinct.

Skin above smooth to minutely granular; sides of head slightly warty; chin and throat fairly smooth; belly and ventral surface of thighs uniformly granulate; proximal area of posterior surface of thighs less so; postaxial side of forearm warty with saw-like fold composed of six or seven large, rounded serrations; postaxial tarsal border with less prominent fold of large obtuse serrations; a low, indistinct fold across breast; a very small anal flap.

Forelimb well developed, strong, and fairly long (46 mm.), 66% of length of head and body; hand 22 mm.; finger discs large, roundish but slightly wider than long, a

little larger than tympanum (5 to 4.5 mm.); fingers in order of length, 1, 2, 4, 3, 4th practically equal to 3rd; extent of webbing between fingers, 27, 53 and 55%, webbing to disc of 4th, fringes to discs of other fingers; subarticular tubercles large and projecting; palm coarsely granulate; large pads at the bases of thumb and 2nd finger; a large divided outer metacarpal tubercle.

Hindlimb well developed, length (131 mm.) 187% of head and body; femur 37 mm., tibia 40 mm., foot 54 mm.; heel reaches beyond snout; toe discs well developed, equal in size to those of fingers, rounded but a little wider than long, a trifle larger than tympanum (5 to 4.5 mm.); toes in order of length, 1, 2, 3 = 5, 4; extent of webbing between toes, 67, 70, 78 and 76%, web to discs of 1st, 2nd and 3rd on postaxial side and 5th on preaxial; fingers fringed where not webbed; subarticular tubercles rounded, distinct; sole granular, prehallux one-third length of thumb.

Vomerine elevations paired, narrowly separated, strongly developed, subtriangular, posterior side of each bearing minute teeth and practically transverse, elevations totally behind line joining centres of choanae and by far greater part behind posterior margins of choanae, each elevation about the size of one of the large choanae; tongue subcircular, free and slightly notched behind, very large, filling entire width of mouth between jaws; no subgular sac.

Dorsal colour bluish-black obscurely and extensively mottled with a rich dark brown; limbs with obscure dark markings, approaching banding on tibiae; ventral surfaces of limbs generally light brown; chin and throat brownish caused by a multitude of tiny dots, and with a few blackish patches at margin of jaw; belly and proximal parts of thighs yellowish white.

Specimens examined and Locality Records: 4 (R.10919, R.10921 A-C, A.M.) Mt. Spurgeon, Q. (Loveridge, M.C.Z., Harvard; collector, P. J. Darlington), 1932; 1 (J.5539, Q.M.) Mt. Spurgeon, Q.; 1 (R.D.M.794) Kuranda, Q. (Wm. Hosmer), 23.ix.1956; 1 (type of *eucnemis*) Sattelberg, New Guinea, vide Lönnberg (1900: 579); 6 (cotypes of *serrata*) Carrington, Malanda and Atherton, all Q., vide Andersson (1916: 17); 1 (M.C.Z.18021) Lankelly Creek, Q.; 1 (M.C.Z.18022) Rocky Scrub, Q.; 6 (M.C.Z.18023-8) Millaa Millaa, Q.; 22 (M.C.Z. 18029-39) Mt. Spurgeon, Q.

The last 30 specimens were collected by P. J. Darlington in 1932, vide Loveridge (1935: 40). His first two localities are in the McIlwraith Range, the third on the Atherton Tableland.

Variation.—The five specimens other than R.10919 examined show only slight variation. The tympanum is always very distinct; the rim may consist of a circle of tiny warts. The serrated edge of the forearm and tarsus is invariably conspicuous, the rounded scallops being plainly visible when viewed at right angles even in J.5539, where the tarsal serrations are low. In R.10921C the snout is sharply pointed. The outer web of the fingers may reach 64%, and the median sides of the 2nd and 5th toes are always webbed to the discs. The heel in all cases reaches to well in advance of the snout. Males may have a black patch on the preaxial side of the thumb. The vomerine elevations are distinctly but sometimes narrowly separated. In R.10921C they are much smaller, less prominent in every way and totally behind the choanae. R.D.M.794 has the tongue noticeably narrower than the mouth and rather deeply notched behind. The three R.10921 frogs have the bluish-black dorsal colour, but it tends to be median and encroached upon at the sides by very light brown. J.5539 may be said to be brown with the blackish as mottling; ventrally it is white with close brown dotting on the throat and thighs. R.D.M.794 is bluish-black dorsally with a few ill-defined pale greyish areas; ventrally it is white with a little pale grey on the throat.

Discussion.—Loveridge (1935: 40) with 30 specimens from four North Queensland localities places *Hyla serrata* Andersson (1916: 17) in the synonymy of *eucnemis*. His largest specimen collected at a height of between three and four thousand feet on Mt. Spurgeon measured 81 mm. Darlington is quoted as "On the solid stone walls of a long tunnel made by miners to deflect a stream; a very damp, cool, and dark habitat". Except for "loreal region high and oblique, not concave" Andersson's description tallies exactly with that of the specimens I have examined. This single discrepancy, which only applies to the concavity of the loreal region, is far outweighed by the close

agreement in all other characters. Andersson notes colour variation in his six specimens collected during the rainy season, and quotes Mjöberg as "the colour changes in a very high degree in agreement with the haunts of the animals" and one specimen "resembled completely the branch of the tree on which it was sitting when caught". Andersson discusses characters which separate his *serrata* from four other allied New Guinea species.

HYLA DAYI Günther.

Synonymy and references: *Hyla dayi* Günther (1897: 406); Loveridge (1935: 38). *Hyla tympanocryptis* Andersson (1916: 19). *Hyla krefftii* (non Günther) Barbour (1914: 202).

Günther's original description (1897: 406) reads: 4. *Hyla dayi*, sp. nov. Tongue subovate, slightly nicked behind. Vomerine teeth in two transverse series, behind the level of the choanae. Head much depressed; snout rather longer than the diameter of the orbit; canthus rostralis distinct, loreal region sloping outwards; interorbital space broader than the upper eyelid; tympanum distinct, one-fourth the area of the eye. Fingers strongly webbed, the web extending to the penultimate phalanx of the third finger; toes fully webbed. Discs of the fingers not quite as large as the tympanum; a fold along the inner edge of the tarsus. The distance between vent and snout equals that between vent and heel. Skin smooth above, granular below; a fold above the tympanum, none across the chest. Uniform brownish above (in spirit), whitish below. Distance of snout from vent 52 mm., length of hind-limb 92 mm.

Description of No. 793 in the collection of R. D. MacKay, a male, probably not quite fully grown, Kuranda, North Queensland, 1.x.1956 (Wm. Hosmer):

A fairly compact frog with moderately long limbs; width of body (11 mm.) 34% of total length of head and body (32 mm.); head subtriangular, slightly longer than broad (12.5 to 11 mm.); snout moderate (6 mm.), 1.5 times diameter of eye (4 mm.), obtusely pointed when seen from above, rounded in profile, extending well beyond lower lip; canthus rostralis distinct, angular; lores concave, oblique; interorbital width slightly greater than that of an upper eyelid (3.5 to 3 mm.), top of the head flat between the prominent, protruding eye bulges; internasal space 3 mm.; diameter of the eye equals its distance from nostril; tympanum very indistinct, being only noticeable in certain lights, directed slightly upward, contained in diameter of eye 3.2 times (1.25 to 4 mm.), distance from eye 1 mm.; a low supratympanic ridge.

Skin smooth above; chin and throat fairly smooth; belly and part of lower and posterior surfaces of thighs granular; upper lip and area about tympanum somewhat granular; a line of eight or nine well-separated small protuberances along postaxial side of forearm; limbs otherwise smooth; no pectoral fold; anal flap extremely small.

Forelimb moderately long and strong (20 mm.), 63% of length of head and body; hand 9 mm.; finger discs distinct but rather small, 1.4 times diameter of tympanum (1.75 to 1.25 mm.); fingers in order of length, 1, 2, 4, 3; extent of webbing between fingers, 21, 39 and 24%; fingers not fringed; subarticular tubercles small but distinct; palm rough with a few large tubercles; thumb not thickened, with a small patch of about 20 tiny black spines on the preaxial border.

Hindlimb moderately robust and long; length (58 mm.) 181% of head and body; femur 17 mm., tibia 18 mm., foot 23 mm.; heel reaches to tip of snout; toe discs small but distinct, about equal in size to tympanum (1.25 mm.); toes in order of length, 1, 2, 3, 5, 4; extent of webbing between toes, 73, 83, 88 and 73%; toes except 4th webbed to discs or nearly so; 4th toe not fringed; subarticular tubercles small and not very distinct; sole smooth; a large oval tubercle at base of hallux, no outer tubercle.

Vomerine elevations very small, quite distinct, oval, oblique, well separated in midline and even more widely so from choanae, which are much larger and rounded, about two-thirds behind a line joining the posterior borders of the choanae; tongue moderately elongated, grooved and a little warty above, free and slightly indented behind, about half width of mouth at angle of jaws; a very large external subgular vocal sac, which when deflated forms two prominent lateral folds and a posterior one resembling a pectoral fold; the sac has a large opening into the mouth on each side of the tongue.

Colour uniform plumbeous above; beneath whitish.

Specimens examined and Locality Records: 1 (R.D.M.793) Kuranda, Q. (Wm. Hosmer), 1.x.1956; 1 (type of *dayi*) Bartle Frere Mountains, Q., vide Günther (1897: 406); 1 (identified as *krefftii*) 20 m. inland from Cairns, Q., vide Barbour (1914: 202); 1 (type of *tympanocryptis*) Malanda, Q., Feb., 1913, vide Andersson (1916: 19); 1 (M.C.Z.4195) Kuranda, Q. (H. L. Clark), 1913, vide Loveridge (1935: 38).

Discussion.—The only frog examined, No. 793, agrees very well with Günther's description (1897: 406). The distance between snout and vent and that between heel and vent is also approximately equal (32 to 35 mm.), and the length of hindlimb to body length 181% compared with 177%. The dorsum of 793 is uniform plumbeous instead of uniform brownish, and the tympanum is contained 3.2 times in the diameter of the eye instead of 4 times. Both these differences are unimportant. Günther's specimen had the tympanum distinct, in 793 it is very indistinct. In this connection Loveridge (1935: 38) gives good grounds for placing *tympanocryptis* Andersson (1916: 19) in the synonymy of *dayi*. Andersson noted that the tympanum was very small and hardly distinguishable on one side. In 793 the finger discs are larger than the tympanum instead of not quite as large. Both Günther's and Andersson's types had the vomerine elevations behind the choanae. In 793 two-thirds are totally behind the posterior borders of the choanae, and Loveridge said of his specimen "the vomerine teeth extend further forward between the choanae than shown in Andersson's figure". The species, which seems to be quite distinct from any other Australian Hyliid, is apparently confined to the Atherton Tableland and nearby highlands.

HYLA GRACILENTA Peters.

Synonymy: *Hyla gracilentia*: Peters (1870: 789); Boulenger (1882: 383); Fletcher (1891: 263-4; 1892: 12; 1893a: 232; 1894: 526); Garman (1901: 14); Andersson (1916: 15); Chisholm (1929: 335); Loveridge (1935: 37). *Pelodryas granulata*?: Peters (1873: 417). *Hyla fordii*: Günther 1876: 47). *Hyla luteiventris*: Ogilby (1907: 31); Loveridge (1935: 38).

Peters' original description (1870: 789) reads: Vomerzähne auf zwei queren Höckern zwischen dem hintern Theil der Choanen. Letztere kaum gröfser als die Tuben. Zunge herzförmig, hinten flach eingebuchtet. Äufserer Mundwinkel unter der Mitte des Trommelfells. Augen mit horizontaler Pupille, um ihren doppelten Durchmesser von einander und um einen von den Nasenöffnungen entfernt. Die Nasenlöcher liegen seitlich, ganz nahe dem Ende der abgestutzten Schnauze, einander ein wenig näher als den Augen. Die Zügelgegend ist abschüssig. Trommelfell kaum halb so grofs wie das Auge, oval. Der Kopf erscheint sehr abgeplattet und ist so breit wie lang. Die ganze Oberseite des Thiers, einschliesslich der seitlichen Theile der Unterlippe, die Aufsenseits des Vorderarms bis zum vierten Finger, die Aufsenseite des Unterschenkels bis zur Spitze der 5. Zehe sind feiner, die Bauchseite und die Unterseite der Oberschenkel gröber granulirt, während der übrige Theil der Gliedmafsen glatt ist. Der Oberarm erscheint auffallend dünn. Der erste und zweite Finger sind zur Hälfte, die drei übrigen über zwei Drittel durch Schwimmhäute mit einander verbunden und die Haftscheiben derselben sind grofs. Die Schwimmhäute der hinteren Extremität sind fast vollständig und gehen bis an die Basis des vorletzten Gliedes der vierten Zehe. Die ganz Oberseite bis zum seitlichen Unterkiefferrande, mit Einschluss des Trommelfells, und die granulirten Theile der Extremitäten sind dunkelblau, die Oberseite des Oberschenkels ist rosenroth und die Körperseiten, die ganze Unterseite, so wie der übrige Theil der Gliedmafsen sind gelblichweifs. Iris am Rande goldglänzend.

Totallänge .. 0,038; Kopflänge .. 0,014; Augendurchmesser .. 0,0035; Augendistanz .. 0,007; Vord. Extr. .. 0,021; Hand .. 0,008; Hind. Extr. .. 0,057; Fufs .. 0,025. Diese schöne Art stammt aus Port Mackay (Nordost-Australien); durch Hrn. Godeffroy.

Description of No. A.C.5357, a male, probably adult, 8 m. S.E. of Calliope, Gladstone district, Queensland, 12.i.1955:

Habitus moderately slender, width of body (15 mm.) 38% of total length of head and body (39 mm.); head subtriangular, very little broader than long (14 × 12 mm.);

snout short (5.5 mm.), about 1.4 times diameter of eye (4 mm.), rather truncate when seen from above, almost vertical in profile, extending hardly at all beyond lower lip; canthus rostralis straight and angular; lores flat, sloping up and inwards evenly from jaw to canthus rostralis; interorbital width about 1.8 times that of an upper eyelid (5 to 2.75 mm.), top of head shallowly concave but eye bulges moderately distinct; internasal space 3.5 mm.; diameter of eye equals its distance from nostril; tympanum distinct although shallow and its surface much as surrounding granulated skin, directed slightly upward, contained in diameter of eye about once and a half (2.75 to 4 mm.), distance from eye 1.25 mm.; an indistinct, short, low supratympanic ridge.

Skin of body and head and all exposed dorsal surfaces of limbs finely and uniformly granulate, ventral surface of body from gular region and underside of thighs more coarsely granular; concealed upper surfaces of upper arm and thigh and ventral surfaces of limbs except for thighs smooth, chin and throat fairly smooth except for small posterior area along margin of lower jaw, which is as dorsal surface; no fold across breast; a wide, thin anal flap.

Forelimb moderately strong and long (24 mm.), 62% of length of head and body; upper arm thinner than forearm, which is widened and thickened, plaque-like; hand 10 mm.; finger discs rather small, rounded, a little smaller than tympanum (2 to 2.75 mm.); fingers in order of length, 1, 2, 4, 3; extent of webbing between fingers, 64, 67 and 74%; web to disc of 4th; fingers narrowly fringed to discs; subarticular tubercles small and rather indistinct; palmar area shallowly divided.

Hindlimb long and slender, length (67 mm.) 172% of head and body; femur 21 mm., tibia 20 mm., foot 26 mm.; heel reaches beyond tip of snout; toe discs small but distinct, slightly longer than wide, smaller than tympanum (1.75 to 2.75 mm.); toes in order of length, 1, 2, 3 = 5, 4; extent of webbing between toes, 65, 83, 75 and 82%; 2nd and 3rd toes and the 1st practically webbed to disc on outer sides and 5th webbed to disc on inner; narrow fringes to toes; subarticular tubercles distinct but small; smooth surface of sole divided longitudinally; no metatarsal tubercles.

Vomerine elevations paired, small, oval and oblique, well separated from each other and from choanae, which they equal in size, practically contained between choanae though extending a little behind line joining posterior margins of choanae; tongue roundish, deeply nicked and free behind, large, about 60% of width of mouth at angle of jaws; large subgular vocal sac with a large opening into the mouth at each side of the tongue.

Dorsal surface of body and all exposed surfaces of limbs including outermost toes and fingers bluish in alcohol; ventral surfaces white with a trace of yellow; these include whole of upper arm which is concealed when the frog is at rest; practically the whole of upper surface of thigh is a rich plum, maroon or even purplish colour; a white line on canthus rostralis, outer border of eyelid and above tympanum is so faint as to be visible only in certain lights at certain angles; a distinct white line along outer edge of forearm, tibia and tarsus.

Specimens examined and Locality Records: 2 (R.2597, R.2637, A.M.) Crow's Nest, Q. (H. J. McCooley), 1900; 1 (R.3964, A.M.) Cooktown, Q. (E. A. Olive), Mar., 1908; 1 (R.4379, A.M.) Brisbane, Q. (A. R. McCulloch), Feb., 1909; 1 (R.5015, A.M.) Brisbane, Q. (Lamb), Dec., 1910; 1 (R.5251, A.M.) Brisbane, Q.; 1 (R.5513, A.M.) Q.; 1 (R.6186, A.M.) Gurravembi, Nambucca River, N.S.W. (D. B. Fry), May, 1913; 15 (R.6309-17, A.M.) Gurravembi, N.S.W. (D. B. Fry and H. E. Smart), Oct., 1913; 1 (R.6656, A.M.) Herbert River, Q. (T. Steel), 14.x.1914; 1 (R.6953, A.M.) Isis Scrub, Q. (T. Steel), Sept., 1916; 3 (R.12492, A.M.) no data; 3 (R.13253, A.M.) Far North Coast, N.S.W. (J. C. Wiburd), 17.viii.1947; 1 (D.3275, N.M.) Australia; 2 (J.9528-9, Q.M.) Cardwell, Q.; 2 (A.C.5357, A.C.5378) 8 m. S.E. of Calliope, Q., 12.i.1955; 1 (M.C.Z.2318) Cooktown, Q. (E. A. C. Olive), 1896; 2 (M.C.Z.2762) Mossman, Q. (J. C. Kershaw), 1912; 1 (M.C.Z.18001) Lankelly Creek, N.E. of Coen, Q. (P. J. Darlington), 1932; 1 (M.C.Z.18487) Lake Barrine, Q. (W. E. Schevill), 1932: last four entries vide Loveridge (1935: 38); Rockhampton, Q., types of *H. fordii*, vide Boulenger (1882: 383); Dunoon and Grafton, both N.S.W., and Cairns, Q., vide Fletcher (1891: 263); Port Mackay, Q., type locality of *gracilentia*, vide Peters (1870: 789); Cooktown, Q. (Olive), vide Garman (1901: 14);

Brisbane, Q., type locality of *luteiventris*, vide Ogilby (1907: 31); Malanda, Carrington and Atherton, all Q., vide Andersson (1916: 15); Comboyne Plateau, N.S.W., vide Chisholm (1929: 335).

Variation.—This little frog is quite distinctive and shows little variation in the sum of its characteristics. The snout to eye ratio is practically constant at 1.4. The tympanum is nearly always covered with the blue, granular skin of the surrounding surface, but is invariably definable because it is slightly sunken. In many cases, as R.13253 (three young males) and the Cardwell and Calliope frogs it would be invisible but for this. The tympanum is contained in the eye from 1.5 to 1.8 times. Sometimes, as in R.5015, the top of the head is practically flat with hardly any trace of the eye bulges. Extremes are rare, but the interorbital width to that of the upper eyelid varies from little more than once to nearly twice. Webbing of fingers and toes is reasonably constant, but in all Gurravambi, the Cooktown and two Brisbane frogs the web does not approach the disc of the 1st toe and generally not that of the 2nd. Finger discs in all are smaller than the tympanum, except in J.9529, where they are equal. Length of the forelimb to that of head and body is very constant, between 60 and 63%; the ratio of the hindlimbs varies between 166 and 177%. The vomerine elevations show remarkably little variation, all being contained between the choanae or almost so; except R.6309, about half of which is behind the line joining the posterior margins of the choanae, and R.2637, which is abnormal in lacking vomerine elevations although another frog collected with it is normal. In all the arm is thin, emaciated in appearance, totally white without trace of the bluish dorsal colour. There is always a large, granular, dorsal, thickened shield over the forearm. It is coloured as the dorsal surface of the body and has an olecranon projection. The dorsal colour is bluish, but a few specimens retain a greenish tinge. R.6186 is quite green although collected more than forty years ago. An occasional frog is exceptionally granular dorsally. J.9529, but not the specimen collected with it, has scattered large warts high on the sides and on the shield of forearm. R.6656 is unique in having the back laterally and the sides liberally sprinkled with small white warts. Specimens may be either immaculate white or various shades of yellow ventrally, very rarely greyish. An extension of the blue, granular dorsal surface to the lower margin of the bottom jaw posteriorly is characteristic. Every specimen has purple on the thighs, except one or two old and bleached specimens. The typical dorsal blue surface does not extend to the thighs. The white line along the canthus rostralis, outer border of upper eyelid and above the tympanum is never very distinct, being often only visible in certain lights. The line occurs in about half the specimens. Its presence or absence seems to occur quite haphazardly and shows no geographical control.

Discussion.—Peters' type specimen (1870: 789) falls wholly within the range of the frogs I have examined. He notes the diagnostic small granular area on the lower lip, the conspicuously lean upper arm, the rosenroth dorsal surface of the thighs, and the yellowish-white underside. He says that the tympanum is hardly half as large as the eye, but in the series examined the tympanum is contained in the eye diameter from 1.5 to 1.8 times. *Hyla luteiventris* Ogilby (1907: 31), as noted by Loveridge (1935: 38), is undoubtedly a synonym of *gracilentia*. Ogilby in his key uses length of snout and hindlimb to heel, distinctness of tympanum and orange lower surfaces to differentiate his species, but these all fall within the range of *gracilentia*. He includes the width of the eye bulges in his interorbital width, which he gives as $2\frac{1}{2}$ times the eye diameter. Ogilby says himself that he considered "all the requirements of the case would be amply met" if *luteiventris* was looked upon as a variety of *gracilentia*. He also includes *chloris* as a subspecies. Reasons against this are noted when that species is discussed. R.4379 marked as a cotype of *luteiventris* in the Australian Museum is undoubtedly *gracilentia*. The specimen has no trace of white lines. Ogilby's frog had a greenish-yellow band from the nostril under the eye to the tympanum, a spot of the same colour on the occiput and a streak along the canthus rostralis to tympanum. The orange-coloured venter which gave the name to his specimen lies between the immaculate white and orange of *gracilentia*. Peters remarked that his species was gelblichweiss. Garman's specimen from Cooktown (1901: 14) and Andersson's five from the Atherton

Tableland (1916: 15) were without white lines on the head. Three of Andersson's specimens were very large (54, 56 and 57 mm.). Chisholm (1929: 335) notes that *gracilentus* is "occasionally seen" on the Comboyne Plateau. This is the most southerly record of which I am aware. The frog is fairly common northwards along the coastal strip at least as far as Lankelly Creek, near Coen, well up on Cape York peninsula. Boulenger's specimens (1882: 383) had the white line on the head, which is present in about half the specimens examined, upper surfaces of thighs purple and largest specimen a 40 mm. male. Nieden (1923: 231) follows his account closely. Loveridge (1935: 37) gives the only discussion on *gracilentus* of which I know. His five specimens also lack a white streak. Loveridge includes a note by W. E. Schevill on a living frog from Lake Barrine that the dorsal surfaces were bright green and the ventral bright yellow—a little paler on the belly and throat. Fletcher (see synonymy) had a number of specimens without the white line from Dunoon on the Richmond River. He records a note by the collector Helms that "this species may almost be called arboreal", and describes colour in life, ecological and distributional notes, and relationship to *chloris*.

HYLA CHLORIS Boulenger.

Synonymy: *Hyla gracilentus* (non Peters): Fletcher (part) (1891: 263-4). *Hyla chloris*: Boulenger (1893: 403); Fletcher (1894: 524-6, 530); Nieden (1923: 232); Loveridge (1935: 38).

Boulenger's original description (1893: 403) reads: Tongue subcircular, slightly nicked and free behind. Vomerine teeth in two small groups between the choanae. Head broader than long; snout rounded, shorter than the diameter of the orbit; canthus rostralis obtuse; loreal region very oblique, slightly concave; nostril nearer the tip of the snout than to the eye; inter-orbital space broader than the upper eyelid; tympanum very distinct, three-fifths the diameter of the eye. Three outer fingers extensively webbed, the membrane reaching the disks of the second and fourth; no distinct rudiment of pollex; toes nearly entirely webbed; disks of fingers as large as the tympanum; subarticular tubercles moderate. Tibio-tarsal articulation reaching the tip of the snout. Upper parts finely granulate; belly and lower surface of thighs coarsely granulate; a strong fold across the chest. Green above; upper arm and throat yellow; sides of thighs purple; beneath uniform white. Male with an external gular vocal sac. From snout to vent 63 millim. A single specimen, from Dunoon, Richmond River, collected by Mr. R. Helms, was submitted to me by Mr. J. J. Fletcher. It is closely allied to *H. gracilentus*, Peters, but differs in the larger size, the larger eye, the obtuse canthus rostralis and oblique loreal region, the very distinct tympanum, the skin of which is free from granulations, and the absence of a white streak along the limbs and round the upper surface of the head. This frog was referred to *H. gracilentus* by Mr. Fletcher (P.L.S.N.S.W. (2), vi.1891, p. 263).

Description of R.12743, in the Australian Museum, an adult male, Lowana, N.S.W., collected by Mel Ward, 17.xii.1943:

Habitus moderately elongated with a rather broad head; total length of head and body 65 mm.; head subtriangular, as long as broad (21 mm.); snout short (9 mm.), 1.4 times diameter of eye (6.5 mm.), slightly truncate when viewed from above, slightly rounded but almost vertical in profile, extending very little beyond lower lip; canthus rostralis rounded; lores very shallowly concave, sloping obliquely upwards and inwards; interorbital space twice that of an upper eyelid (8 to 4 mm.), top of the head flattish with moderately prominent eye bulges; internasal space 4.75 mm.; diameter of the eye distinctly more than its distance from nostril; tympanum quite distinct, nearly smooth and flat with only a trace of granulation, almost vertical, contained in diameter of eye 1.6 times (4 to 6.5 mm.), very close to eye; supratympanic fold distinct but not projecting far.

Skin above and at sides of head granular, including limbs and a narrow strip on the dorsal surface of each thigh; sides of body granulate but nearly smoothed; chin and throat including external vocal sac and forearms rather coarsely granulate; body and thighs ventrally more coarsely so; tibia and tarsus nearly smooth ventrally; pectoral fold slight; a fold dorsally across wrist; a thin, wide anal flap.

Forelimb strong and moderately long (40 mm.), 62% of length of head and body; hand 18 mm.; forearm thick-set and widened, with a postaxial serrated ridge which extends along the 4th finger; arm much smaller; finger discs well developed, slightly widened, equal to tympanum (4 mm.); fingers in order of length, 1, 2, 4, 3; extent of webbing between fingers, 56, 70 and 75%; web reaches discs of 2nd and 4th fingers on their median side; rather wide fringes; subarticular tubercles moderately distinct; palm granular; thumb with a pad basally and a black preaxial and dorsal nuptial shield.

Hindlimb long and strong, length (108 mm.) 166% of head and body; femur 34 mm., tibia 31 mm., foot 43 mm.; heel reaches to tip of snout; toe discs well developed, rounded, a little smaller than tympanum (3.5 to 4 mm.); toes in order of length, 1, 2, 3 = 5, 4; extent of webbing between toes, 75, 75, 90 and 92%; highly granular web to all discs on median side except 4th; wide fringes, that of 5th the continuation of a pronounced tarsal fold; subarticular tubercles low and rounded; sole divided and granular, smooth proximally; a flattened inner metatarsal tubercle, no outer one.

Vomerine elevations paired, fairly prominent, narrowly separated from each other and widely from the much larger choanae, transverse not oblique, totally contained between choanae; tongue oval, free and feebly indented behind, only about half width of mouth; a large external vocal sac with a slit-shaped opening into the mouth at each side of the tongue.

Dorsal colour, including exposed surfaces of limbs, greenish-blue; dorsal surface of thigh much the same, purplish on sides; arm above quite white; the dorsal blue extends as a narrow margin almost completely around the bottom of the lower jaw; ventral surfaces pale yellow; no trace of white on head; serrated ridge of forearm white.

Specimens examined and Locality Records: 1 (R.5846, A.M.) Wollongbar, Richmond River, N.S.W. (Dept. of Microbiology), Aug., 1912; 1 (R.7339, A.M.) Goangara, near Walgett, N.S.W. (J. J. Fletcher), Nov., 1921; 8 (R.7484-7491, A.M.) Dunoon, Richmond River, N.S.W. (J. J. Fletcher), Feb., 1922; 1 (R.9902, A.M.) Gosford, N.S.W. (A. F. D'Ombraïn), May, 1929; 2 (R.12635-6, A.M.) Lowana, North Coast, N.S.W. (Mel Ward), 11.i.1943; 1 (R.12743, A.M.) Lowana (Mel Ward), 17.xii.1943; Maclean (A. S. Olliff) and Ulmarra to Chatsworth (A. Lea), all localities on the lower Clarence River, N.S.W., vide Fletcher (1894: 524-5).

All 14 Australian Museum specimens have been examined. The Dunoon specimens are topotypes.

Variation.—The tympanum is always minutely granular but the general effect gives the impression of smoothness and the tympanum is invariably very distinct. The head and body of all frogs are granular dorsally. The dorsal surface of the thighs is nearly always smooth, and the narrow, dorsal, granular strip, when present, is confined to the ends, except in R.12636 and R.12743, where it is distinct for the whole length. R.5846 is shagreened dorsally. Although seldom prominent, the serrated ridge of the forearm is constantly present and picked out in white. In R.5846 it is more or less continuous. The ratio of the length of the forelimb to that of head and body is very constant; eight of 14 frogs lie within 1% of the average of 66%, the extremes being 60 and 69%. Webbing reaches the discs of the 2nd and 4th fingers on the median side, or practically so, but is distinctly separated from the other discs in seven of 14 frogs examined. It reaches that of the 4th only in four cases, while in three it is well separated from all discs. Percentage of webbing between the 2nd and 3rd fingers varies between 60 and 70%. Finger discs may be larger than, smaller than, or equal in size to the tympanum in about equal proportions. The length of the hindlimb to that of head and body varies between 160 and 183%, with an average of 174%. The heel reaches exactly to the tip of the snout in three specimens, slightly beyond in 10, and a trifle short in one. Percentage of webbing between the 3rd and 4th toes varies considerably between 75 and 90%. Excluding the 4th toe the web reaches to the discs of all toes, except to that of the 1st in four cases. The largest toe disc equalled the tympanum in size twice and was smaller in the rest. The vomerine elevations of 10 frogs agree very well with those of R.12743. There is a tendency for them to become slightly oblique and to be well separated; this is particularly well shown in R.5846 and R.7488. R.7487 has them joined to form one transverse series. Most specimens have practically immaculate

yellow or white upper arms, but two or three of the eight Dunoon frogs as well as R.7339 and R.12636 have a trace of blue on its dorsal surface. The colour above is nearly always bluish with little or no suggestion of green, except R.5846, which is quite green. The dorsal surface of the thighs is much as the dorsum in 10 cases, purplish in four. The largest specimen measured 65 mm. from snout to vent, three were over 60 mm., and the average was 57 mm. Of 14 frogs examined, 11 were males.

Discussion.—Boulenger as usual (1893: 403) went straight to the point by characterizing his species *inter alia* by its larger size, distinct tympanum and uniform head colour. He notes that Fletcher (1891: 263) referred the frog to *gracilentia*. Although Fletcher sent the single specimen described to Boulenger, he was in doubt about the species and wrote (1894: 526) regarding *gracilentia* and *chloris*: "I am disposed to regard them as referable to one and the same species." The limited number of specimens examined indicates that *chloris* is a very homogeneous species. Only the Wollongbar frog differs in its unusual granulation and conspicuous green colour. *Chloris* appears to be almost confined to the narrow coastal strip from about Gosford to the Queensland border. I am practically certain that the frog from near Walgett has been correctly identified, and if so the species must extend to the highlands and have been carried down at least one of the western streams—the Namoi River, which runs from about Bendemeer through Walgett.

HYLA CAERULEA CAERULEA (Shaw).

Synonymy and references: *Rana caerulea*: Shaw in White (1790: appendix, 248) (1802: 113); Daudin (1803: 70), Merrem (1820: 174). *Rana Austrastae*: Schneider (1799: 150). *Rana coerulea*: Daudin (1803: 70). *Hyla cyanea*: Daudin (1803: 43); Fitzinger (1826: 64); Tschudi (1838: 73); Schlegel (—: 26); (part) Duméril and Bibron (1841: 577); Cope (—: 204). *Calamita cyanea*: Fitzinger (1826: 64). *Calamites caerulea*: Wagler (1830: 200). *Hyla caerulea*: Gray (1842: 56); Günther (1863: 249); Boulenger (1882: 383; 1912: 211); Fischer (1883: 21, 55); Fletcher (1889: 365, 368-371, 381, 385; 1890: 669-675; 1891: 264-5, 272; 1892: 12; 1894: 524, 526, 528-530; 1898: 669, 682); Garman (1901: 14); Lucas and Le Souef (1909: 292); Fry (1912: 100; 1914: 209); Barbour (1914: 201); Andersson (1916: 15); Nieden (1923: 223); Kampen (1923: 27, 56, 58, 60); Chisholm (1925: 62); Lankes (1928: 6); Noble (1931: 409); Loveridge (1935: 39; 1948: 404; 1949: 214); Mitchell (1955: 404). *Hyla (Calamites) cyaneus*: Fitzinger (1843: 30). *Pelodyras caeruleus*: (part) Günther (1858: 119; 1863: 249-250; 1867: 57); Krefft (1864: 390; 1865: 16-20; 1866: 33). *Calamites cyaneus*: Fitzinger (1860: 413); (part) Steindachner (1867: 66); Parker (1868: 76). *Pelodyras coeruleus*: Günther (1863: 250); Keferstein (1868b: 288). *Calamites cyanea*: Cope (1867: 201, 204). *Hyla caerulea s. cyanea*: Gadow (1901: 198).

I am indebted for part of the synonymy to Keferstein, Boulenger and Nieden.

Shaw's original description (1790: 248) reads: The Blue Frog. *Rana Caerulea*. *Rana caerulea*, subtus griseo-punctata, pedibus tetradactylis, posterioribus palmatis. Magnitudo Ranae temporariae. Blue Frog, speckled beneath with greyish; the feet divided into four toes; the hind-feet webbed. Size of the common Frog.

Description of a topotype, No. A.C.5447, an adult male, Curl Curl, Sydney, N.S.W., 16.ii.1955:

Habitus rather stout and squat; total length (90 mm.); head squarish, somewhat broader than long (32 to 27 mm.); snout short (12 mm.), one and a half times diameter of eye (8 mm.), truncate when viewed from above, slightly rounded but almost vertical in profile, extending very little beyond lip; canthus rostralis short, rounded, and rather indistinct; lores distinctly concave horizontally, sloping upwards obliquely and inwards from jaw to canthus rostralis; interorbital width greater than the width of an upper eyelid (9 to 7.5 mm.), the top of the head is only shallowly concave and the eye bulges are not very distinct; internasal space 7.5 mm.; diameter of the eye equals its distance from nostril; tympanum very distinct, directed slightly upward, contained in diameter of eye 1.3 times (6 to 8 mm.), distance from eye 4 mm.; a well-defined supratympanic fold extending to just behind shoulder.

Skin thick and smooth above, with many distinct pores on the head and body back to about the level of the shoulders; chin and throat granular but fairly smooth; abdomen and ventral surfaces of thighs uniformly and coarsely granulate; forearm, leg and most of foot quite smooth; fold across breast; a very small anal flap.

Forelimb short (36 mm.) and strong, 40% of length of head and body; hand 22 mm.; finger discs well developed, slightly wider than long, a very little larger than tympanum (6.5 to 6 mm.); fingers in order of length, 1, 2, 4, 3; extent of webbing between fingers, 35, 38, and 48%; subarticular tubercles large and rounded; palmar area coarsely divided; thumb with large pad and black roughening on inner and dorsal edge.

Hindlimb moderately strong, length (134 mm.) 149% of head and body; femur 40 mm., tibia 40 mm., foot 54 mm.; heel reaches to centre of tympanum; toe discs well developed, slightly wider than long, a little smaller than tympanum (5.5 to 6 mm.); toes in order of length, 1, 2, 3 = 5, 4; extent of webbing between toes, 52, 48, 61 and 63%; all toes with fringes to discs; subarticular tubercles large, elongated and rounded; numerous flattened supernumerary tubercles on sole, which is deeply divided longitudinally; slight fold along inner side of tarsus; inner metatarsal tubercle large, distal end somewhat free; no outer tubercle.

Vomerine elevations paired, contiguous or just separated, heavy, oblique, triangular, posterior sides of elevations in a straight line well behind the level of the choanae and each bearing about six very small rounded teeth, anterior lateral angle at level of midline of choanae, width of each elevation equal to that of one of the choanae, which are large, choanae barely separated from elevations; tongue large, almost quite circular, free behind, slightly indented before and behind, half width of mouth at angle of jaws; large, subgular vocal sac with a prominent opening into the mouth at each side of the tongue.

Dorsal colour dark bluish in alcohol, yellowish-white below; about half a dozen white spots 0.5 mm. across irregularly scattered on each side.

Specimens examined and Locality Records: 1 (A.C.189) near Yarramalong, N.S.W., 23.x.1938; 1 (A.C.1364) 1 m. N. of Fitzroy Falls, N.S.W., 8.x.1941; 1 (A.C.3760) Horton's Creek, N.S.W., 3.i.1948; 1 (A.C.3858) 7 m. W. of Grafton, N.S.W., 6.i.1948; 1 (A.C.3882) Nettle Creek, 12 m. from Copmanhurst, N.S.W., 7.i.1948; 1 (A.C.4015) Karara, Q., 11.i.1948; 1 (A.C.4115) Sydney, N.S.W., 30.iv.1948; 18 (A.C.4178, 4198-4200, 4203-4212, 4222-5) Failford, near Tuncurry, N.S.W., 21.xii.1948-9.i.1949; 1 (A.C.4727) 5 m. S. of West Wyalong, N.S.W., 11.vi.1951; 1 (A.C.4800) Glenelg, N.S.W., 10.vi.1951; 1 (A.C.4939) Bollon, Q., 10.i.1953; 1 (A.C.5039) Nambucca Heads, N.S.W., 15.vi.1948; 10 (A.C.5128-5137) 1 m. N. of Jandowae, Q., 30.xii.1954; 3 (A.C.5154-6) 1 m. N. of Winderah, Q., 1.i.1955; 1 (A.C.5212) 34 m. W. of Eidsvold, Q., 5.i.1955; 1 (A.C.5216) 11 m. N. of Moura, Q., 6.i.1955; 2 (A.C.5244-5) 1 m. N. of Baralaba, Q., 7.i.1955; 1 (A.C.5298) 23 m. S. of Wowan, Q., 11.i.1955; 2 (A.C.5355-6) 8 m. S.E. of Calliope, Q., 12.i.1955; 1 (A.C.5447) Curl Curl, Sydney, N.S.W., 16.ii.1955; 1 (R.223, A.M.) 22 m. inland from Cairns, Q. (Cairn and Grant), Jan., 1888; 1 (R.1232, A.M.) N.S.W. (Smart), 22.ix.1892; 1 (R.1899, A.M.) Waverley, Sydney, N.S.W. (J. Brazier), Dec., 1895; 1 (R.2826, A.M.) Smithfield, near Sydney, N.S.W. (J. Stein); 1 (R.3538, A.M.) Mapoon, Gulf of Carpentaria, Q. (C. Hedley), July, 1903; 3 (R.3833, R.4289-90, A.M.) Parramatta, N.S.W. (A. R. McCulloch), 1909; 6 (R.4292-4, R.5243-5, A.M.) Darling River floods (R. Helms), May-June, 1890; 1 (R.4320, A.M.) Gladstone, Q. (A. R. McCulloch), 22.i.1909; 6 (R.4520-4, R.5355, A.M.) Murray Id., Torres Strait (Hedley and McCulloch), June, 1909, and Aug., 1911; 1 (R.4614, A.M.) New Guinea (Geog. Soc. Exped.), 1885; 1 (R.5088, A.M.) Randwick, Sydney, N.S.W. (W. W. Thorpe); 1 (R.5092, A.M.) Bondi, N.S.W. (J. Blair), Jan., 1911; 1 (R.5177, A.M.) Sans Souci, Sydney, N.S.W. (J. H. Wright); 1 (R.5437, A.M.) Lismore, Richmond River, N.S.W. (R. J. Thorpe), Dec., 1911; 4 (R.6115, R.6328-30, A.M.) Eidsvold, Burnett River, Q. (T. L. Bancroft), 1913; 3 (R.6522-4, A.M.) Sylvania, Q. (F. L. Berney), Dec., 1913; 2 (R.6648-9, A.M.) Herbert River, Q. (T. Steel), 14.iv.1914; 3 (R.7336-8, A.M.) Goangra, near Walgett, N.S.W. (J. J. Fletcher), Nov., 1921; 1 (R.7356, A.M.) Narrabri, N.S.W. (J. J. Fletcher), Nov., 1921; 3 (R.7407, A.M.) Bearbong, Mundooran, N.S.W. (J. J. Fletcher), Nov., 1921; 1 (R.7464, A.M.) Dunoon, Richmond River, N.S.W. (J. J. Fletcher), Feb., 1922; 1 (R.7508, A.M.) Inverell, N.S.W. (J. J.

Fletcher), Feb., 1922; 1 (R.7930, A.M.) Moa Id., Torres Strait (W. McClennan), Sept., 1922; 2 (R.7972-3, A.M.) Upper Colo, N.S.W. (Kinghorn, Fletcher and Wright), Oct., 1922; 1 (R.8088, A.M.) Bulahdelah, N.S.W. (H. L. Kesteven), Oct., 1923; 1 (R.8243, A.M.) Darwin, N.T. (W. E. J. Paradiance) 1923; 2 (R. 9428-9, A.M.) Wentworthville, near Sydney, N.S.W., Jan., 1928; 1 (R.9621, A.M.) Almaden, Q. (W. J. Campbell), 14.xi.1928; 6 (R.9658-63, A.M.) Thursday Id., Torres Strait (Mel. Ward), 14.xi.1948; 1 (R.9680, A.M.) Murray Id., Torres Strait (Mel. Ward), 16.xi.1929; 3 (R.9721-3, A.M.) Groote Eylandt, N.T. (H. E. Warren), 10.i.1929; 4 (R. 9954, A.M.) Bushman Range, Dorrigo, N.S.W. (W. Heron), 5.vii.1929; 2 (R.10193, R.11021, A.M.) Groote Eylandt, N.T. (H. E. Warren and H. L. Perryman); 1 (R.11053, A.M.) Moree, N.S.W. (J. R. Kinghorn), 1933; 1 (R.11070, A.M.) Wyong, N.S.W. (J. H. Wright), Dec., 1933; 1 (R.11154, A.M.) Tyalgum, Tweed River, N.S.W. (J. Marshall), 1934; 3 (R.11161, R.11361, R.11706, A.M.) Lindeman Id., Q. (Mel. Ward); 1 (R.11319, A.M.) Almaden, Q. (W. D. Campbell), Aug., 1934; 4 (R.11593-4, A.M.) Pilliga, N.S.W. (S. Benney), 1935; 1 (R.11781, A.M.) The Plains, Nyngan, N.S.W. (D. Wass), 1936; 3 (R.12401-3, A.M.) Yirrikala, Caledon Bay, N.T. (C. W. Chaseling), 23.viii.1939; 1 (R.12900, A.M.) Darwin area, N.T. (T. R. Tovell), 23.iii.1945; 2 (R.13125-6, A.M.) Tenterfield, N.S.W., Dec., 1946; 1 (R.13628, A.M.) Groote Eylandt, N.T. (J. E. Bray); 1 (R.13645, A.M.) Cape Arnhem, N.T. (J. E. Bray); 1 (R.14802, A.M.) Bowen, Q. (S. J. Kellner), Jan., 1956; 1 (A.4909, A.M.) Port Darwin, N.T. (A. Morton), 1879; 1 (7069, A.M.) Port Denison, Q. (W. Macleay); 1 (7073, A.M.) Sydney, N.S.W., (G. Krefft); 1 (7074, A.M.) Ash Island, N.S.W. (H. Scott); 1 (7077, A.M.) Rockhampton, Q. (T. Nobbs); 2 (7060, 7394, A.M.) no data; 1 (D. 7086, N.M.) Brisbane, Q.; 1 (D.8116, N.M.) Cairns, Q.; 8 (D.8715-22, N.M.) St. George, Q.; 2 (J.400, J.4035, Q.M.) Brisbane, Q.; 2 (J.1854-5, Q.M.) Darnley Id., Torres Strait; 1 (J.1910, Q.M.) Dunk Id., Q.; 2 (J.5278, J.5280, Q.M.) Palm Id., Q.; 2 (J.6073, J.6085, Q.M.) Capella, Q.; 2 (R.3823, S.M.) Shoal Bay, Rockhampton, Q. (J. Baldwin), 14.vi.1956; Port Essington, N.T., Moreton Bay, Q., Nicol Bay, W.A., Sydney, N.S.W., vide Günther (1867: 57); Port Bowen and Townsville, Q., vide Garman (1914: 14); Carrington, Q., vide Andersson (1916: 15); Comboyne Plateau, N.S.W., vide Chisholm (1925: 62); Sydney, N.S.W., Mer Island, Torres Strait, Darwin, N.T., Port Bowen, Brisbane; Townsville, Burnett River, MacPherson Range, Coen, and Towri Stn., near Richmond, last seven localities Q., vide Loveridge (1935: 39); Napier, Broome Bay, W.A., vide Fry (1914: 209); 4 (M.C.Z.25992-3) Berrima, N.T., vide Loveridge (1949: 214); 1 (U.S.N.M.128267) Uumba Kumba, Groote Eylandt, N.T., vide Mitchell (1955: 404); 1 (U.S.N.M.128530) Yirrkalla, N.T., vide Mitchell (1955: 404).

All 167 specimens from the Australian museums and author's collection have been examined except R.10193.

Variation.—The snout is fairly constant in length, but may be a little shorter than 1.5 times the diameter of the eye, but never more than that ratio. The tympanum is always contained between 1.25 and 1.5 times in the diameter of the eye, generally nearer the lower figure. The back is smooth except for fine pitting, which usually becomes less distinct posteriorly. A few large specimens such as R.11361 are very heavily pitted about the head and forepart of body. Almost exactly half the 166 frogs examined have the largest finger disc equal in size to the tympanum. Another quarter are smaller, sinking to $\frac{3}{4}$ the size, while the remaining quarter are larger, often 1.3 times and in one case 1.7 times the diameter of the tympanum. The inner metatarsal tubercle is large and elongated. There is no outer one, but there is a small rounded tubercle in line with the 3rd or 4th toe. Webbing between the fingers is normally constant, but in extreme cases that between the 3rd and 4th fingers is as low as 38% but not higher than 50%. The length of the hindlimb varies between 140 and 163% of that of head and body. The vomerine elevations are rather conservative. Most are very similar to those of A.C.5447. They are usually well separated, but a few are closely approximated and R.5177 has them contiguous. In J.6073 they are entirely behind the choanae, but in J.1910 and J.5278 are very strong and extend to the anterior borders of the choanae. The dorsum is usually bluish in spirit, but some frogs are greenish and even fewer brownish. An odd one remains very green. The white spots on the sides are never arranged in rows but are scattered haphazard. R.4294, R.7337,

R.8088 and D.8722 are very heavily spotted about the sides and the spots extend to the back and head. Individuals that are fairly heavily spotted—often an average of about 20 on each side—amount to 16%. Those with a few large or small, but moderately distinct, spots account for another 22%; 31% have one or two odd indistinct spots, while 28% are plain and unspotted. There is a white patch or spot under the tympanum in 53% of cases; it is missing in the remainder. This mark generally forms part of a white line which runs from near the angle of the jaws to over the shoulder, but which is not present so often (38 to 53%). This last line is nearly always discontinuous and rarely the same on both sides. There is a white spot, which is generally quite prominent when present, on the upper arm in 37% of specimens. The stripe along the tarsus and part of the tibia is distinct to very distinct in 41% of frogs, faint to practically absent in another 32%, and absent in 27%. In life the backs may be of various shades of vivid bright light to dull greens, or even rarely brownish. The ventral surfaces are white or yellowish, occasionally with some rusty red, a red or pink suffusion, and in an odd case a greenish rim to the lower jaw. The biggest specimen measured 103 mm., with the largest finger disc 10 mm. and tympanum 6 mm.

Discussion.—*Caerulea* is the best known of all Australian Hylids and appropriately was the first to be described. White in 1790, in the advertisement at the beginning of his book, thanks the "Gentlemen, through whose abilities and liberal communications, in the province of Natural History, he has been enabled to surmount those difficulties that necessarily attend the description of so great a variety of animals, presented for the first time to the observation of the Naturalist, and consequently in the class of Nondescripts. Among those Gentlemen he has the honour, particularly, to reckon the names of Dr. Shaw . . . Dr. Smith and John Hunter . . .". White's disclaimer and the evidence of Shaw's publications leaves little doubt that the species is correctly ascribed to Shaw. Whether this is in accord with the rules for nomenclature is uncertain. The original description is accompanied by a plate which gives a pleasing picture of vegetation in the setting of a drowned river valley typical of the Hawkesbury Sandstone near Sydney, but a poor representation of the frogs. Four of them are shown with the dorsal blue of long-preserved spirit specimens. The ventral surfaces are of an unnatural brown and this colour extends over much of the head. The limbs distally from the elbows and knees are jet black. There are no lateral white spots. Krefft's early notes (1865: 16-20, and 1866: 33) include "Pelodryas caeruleus is quite a domestic creature, taking up its quarters under the roof of dwelling-places, in water-spouts, post-holes, etc. and it has proved itself a surer prophet than Mr. Saxby—the deep croak of the male being a certain sign that rain will not long be wanting. The Great Green Tree Frog is the largest of our Batrachians, found in every part of Australia, and in New Guinea. I have seen specimens as large as a man's fist. This species feeds upon almost every living object that can be swallowed: lizards, frogs, all kinds of insects, and young birds—for I have once taken the nestling of a small honey-eater out of the stomach of one of these insatiable reptiles." Gray (1842: 56) notes a specimen collected by Gilbert at Port Essington and says that it differs from M. Duméril's description "chiefly in the fore feet being not so much webbed as he describes them". Günther (1863: 249-250) makes long, interesting observations on colour in life, behaviour in captivity, feeding habits, call, and characters such as the spots and comparative shortness of the hindlimbs. He remarks "these frogs soon become familiar, especially the male, which, when I went to feed them, used to approach and to watch the opening through which I introduced the flies into their cage". Boulenger (1882: 383) gives a standard description and then divides the species into two colour varieties. One from Port Essington and N. Australia with no spots and no or only a very indistinct light line along the tarsus; and the second from Nicol Bay, Port Essington, Moreton Bay and Sydney with spots on the side, humerus and sometimes back; a streak from the upper lip to shoulder, generally interrupted under the tympanum; and streaks on postaxial sides of limbs. Fletcher (see synonymy) has about 30 references to breeding behaviour, tadpoles, habits, spotting of sides and back, other characters, and distribution of *caerulea*. Garman (1901: 14) in his colour note says that his specimens from Port Bowen and Townsville were unspotted. Gadow (1901: 198) gives a very good account,

extending over four pages, of this species, dealing with various diagnostic features, but mainly habitat and food preferences, colour changes and voice. He gives information which as far as I know has not been printed elsewhere. His account is too long to be quoted here but should be consulted. However, his remarks on the characteristic spotting are most relevant. Gadow says: "A conspicuous feature of this species is the frequent occurrence of white specks or spots, which are probably due to the deposition of guanine, a peculiar white colouring matter. The spots appear in any part of the green skin, and are quite irregular in their distribution. Sometimes they remain for weeks in the same place, or they disappear after a few days and others appear. They are in no way connected with the shedding of the skin, nor do they indicate ill-health." Chisholm (1925: 62) found that *caerulea* was "very rare and only seen once, and never heard" on the Comboyne Plateau. Loveridge (1935: 39) included both De Vis' *irrorata* and Spencer's *gilleni* in the synonymy. His remarks are dealt with further under *gilleni*. Loveridge's 30 specimens were all without lateral white spots except a large Coen frog. This low proportion of about 3% of unspotted frogs is remarkable when compared with the 28% of 166 specimens from much the same range examined by the present author. Loveridge also discusses other characteristics as digital discs and webbing, limb proportions and coloration. Colour in life of a Darwin specimen is quoted from H. L. Clark. The frog's penchant for living about houses and other buildings is remarked on in Darlington's field note that the Coen individuals were found "in rain gutters during the day; squatting on verandah rails and fence posts at night". Loveridge later (1948: 404) deals with New Guinea frogs from Merauke.

HYLA CAERULEA GILLENI Spencer.

Synonymy and references: *Hyla gilleni*: Spencer (1896: 173); Fry (1912: 97, 99). *Hyla caerulea*: Fletcher (1898: 681); Fry (1914: 209). *Hyla caerulea* (part): Loveridge (1935: 39).

Spencer's original description (1896: 173) reads: *Hyla gilleni*, sp. n. (Plate XV, Figs. 14-17). Tongue large, distinctly notched and free behind. Vomerine teeth in two distinct groups at the level of the hinder edge of the choanae. Head large, as long as broad. Snout broadly truncate and slanting downwards and backwards, so that the nares are vertically in front of the anterior edge of the lower jaw. Canthus rostralis distinct, the loreal region nearly vertical and somewhat concave. Interorbital space considerably broader than the upper eyelid. Tympanum distinct, from three- to four-fifths the diameter of the eye. Fingers slightly webbed. Toes two-thirds webbed. Discs on the fingers larger than those on the toes, and from a half to two-thirds the size of the tympanum. Subarticular tubercles well developed. A well-marked inner and small outer metatarsal tubercle developed. A distinct fold is present across the chest, and another extending from behind the eye over the tympanum to the shoulder. The hind limb being carried forward along the body, the tibio-tarsal joint just reaches the eye. Skin smooth above, granulate beneath. Colour green above. A white patch at the hinder and lower edge of the tympanum and another on the anterior face of the arm close to the body. White spots may be present irregularly scattered along the sides of the body and on the anterior face of the hind limbs. Length of largest specimen (mature ♀) in spirits from snout to vent 63 mm. Locality: Alice Springs. I am indebted to Mr. Gillen, of Alice Springs, for three specimens of this frog, which is only obtainable after rain. One specimen was kindly given to me whilst at Alice Springs by Mr. Crick. Two specimens are mature, one a male and the other a female. There is no difference between them, except that in the male the webbing of the toes is very slightly less than in the female; but the difference is so slight that it may be due to a greater contraction caused by the spirits in the one case than in the other. With regard to its habits we know nothing as yet. The fact that it is found after rain may possibly indicate that it aestivates in burrows, but there is no direct evidence of this. *Hyla rubella* is found in and around water-holes at Alice Springs during the dry season, but no trace of *Hyla gilleni* can be found. I have much pleasure in associating with this species the name of Mr. Gillen, to whom I am indebted for very valuable assistance in many ways.

Specimens examined and Locality Records: 1 (D.7036, N.M.) Alice Springs, C.A.; 7 (D.7780-6, N.M.) Telipata Gorge, Western Macdonnells, C.A.; 1 (R.6984, A.M.) Kimberley Dist., W.A. (H. Basedow), Apr., 1917; 1 (R.1258, W.M.) Broome, W.A.; 2 (R.8730-1, W.M.) Carlton Reach, Ord River, W.A.; 1 (R.8793, W.M.) Ivanhoe Stn., Ord River, W.A.; 6 (R.10331-6, W.M.) Fitzroy River, W.A.; Nicol Bay and Junction of Fitzroy River and Margaret Creek, W.A., vide Fletcher (1898: 681); Napier, Broome Bay, W.A., vide Fry (1914: 209).

Discussion.—*Hyla c. gilleni* has been retained as a subspecies on the basis of colour markings and smaller discs. There are other small differences. Nineteen specimens from Western and Central Australia have been assigned to this subspecies, including nine from Spencer's type locality of *gilleni* or near by. One must agree with Loveridge (1935: 39) that *gilleni* does not deserve specific rank. Nevertheless western and central frogs differ from eastern ones to a noticeable degree. White markings are much less conspicuous in western frogs. The characteristic spotting of the sides and back present in 72% of eastern frogs is absent in three cases, present in six but small, and fairly well marked in one. Four of the nine C.A. specimens had small spots. One C.A. and three W.A. individuals had spots under the tympanum, but they were very small and not nearly as prominent as in eastern frogs, where they occur in 53% of cases. The conspicuous white stripe from the angle of the mouth to over the shoulder in 38% of eastern frogs is present in only one from W.A. and is indistinct in five from C.A. The white spot on the upper arm of 37% of eastern frogs is present on two C.A. and three W.A. specimens, but as two or three quite small spots. These remarks are quite definite for the W.A. frogs which are in a good state of preservation. The C.A. frogs are older and all brown. Although Spencer mentions irregularly scattered spots along the sides of the body and anterior face of the hindlimbs and a white patch on the hinder and lower edge of the tympanum and another on the anterior face of the arm close to the body, they are indistinct in the Telipata Gorge and Alice Springs specimens. In contrast markings are very plain on many old eastern frogs. Finger discs are smaller in W.A. specimens, averaging 90% the size of the tympanum, while in C.A. ones they only average 66%. Spencer says "one half to two-thirds the size of the tympanum". Loveridge remarks on the finger discs: "Spencer states of *gilleni* that they are half to two-thirds. The figure of the latter, however, shows some discs as large as the tympanum and it may be postulated that some are contracted from immersion in the spirit of which he writes." This is almost so as the figure shows the largest discs about 90% the size of the tympanum. However, in the nine specimens examined the discs do not appear to have shrunk to any extent. I think preservation can be blamed for only a small part of the low figure. Only two W.A. specimens have the largest disc equal to the tympanum in size; none is larger. Webbing of both fingers and toes is less than for eastern frogs. The tympanum of *c. gilleni* is very distinct and fairly constant at 80% the diameter of the eye. Possibly C.A. frogs are distinct from both eastern and western ones, being isolated in semi-desert areas while the western form differentiated after its long migration along the northern coasts. A new name would then have to be found for the western form. Noble (1931: 409), discussing the unusual cry of alarm given by some frogs, quotes Lankes (1928: 6) that the male *Hyla caerulea* gives this call without provocation, and continues "the cry is often given when a frog is seized by a snake, and while it may fail to frighten off the serpent, it may at least warn other frogs in the neighbourhood".

HYLA INFRAFRENATA INFRAFRENATA Günther.

Synonymy and references: *Hyla cyanea* (non Daudin): Schlegel (1837:44:26). *Hyla cyanea* (part.): Duméril and Bibron (1841: 577). *Pelodryas caeruleus* (part.): Günther (1858:119); Kesterstein (1868b:288). *Calamites cyaneus* (part.): Steindachner (1867:66). *Hyla infrafrenata*: Günther (1867:56); Boulenger (1882:384-5; 1885:387; 1912:212-3); Méhely (1898:176); Fry (1912:100; 1913:49); Nieden (1923:205); Kampen (1923:24, 26, 27, 38, 51, 54, 56-7); Kinghorn (1928:289). *Calamita dolichopsis*: Cope (1867:201, 204). *Hyla dolichopsis*: Boulenger (1882:384); Ogilby (1890:100); Méhely (1898:176); Lonnberg (1900:580); Werner (1900:118); Kampen (1906:171; 1909:33; 1923:52, 55); Roux

(1910:229); Barbour (1912:76). *Litoria guttata*: Macleay (1878:138); Fry (1913:49). *Pelodryas militarius* (a subspecies of *infrafrenata*): Macleay (1878:138). *Hyla aruensis*: Horst (1883:242). *Hyla dolichopsis* var. *tenuigranulata*: Boettger (1895:136). *Hyla sanguinolenta*?: Kampen (1909:33). *Hyla spengleri*: Boulenger (1912:215). *Hyla infra-frenata infra-frenata*: Loveridge (1948:402).

Günther's original description (1867:56) reads: *Hyla infra-frenata*, sp. n. Snout short, rounded, with obtuse canthus rostralis. Vomerine teeth in two transverse series on a level with the hind part of the choanae, which are wide. Skin minutely granular. Fingers one-third webbed. Uniform green above (bluish in spirits). A pure white band round the margin of the lower jaw, and continued in a straight line to below and behind the tympanum. Lower parts whitish. Cape York. Body $1\frac{3}{4}$ inch long, hind limb 3 inches, foot $\frac{3}{4}$ inch.

Description of D.3286, in the National Museum, Melbourne, probably an adult female, Cairns, Queensland:

Habitus rangy, long limbed, and with wide head and narrow waist, width of body (30 mm.) 31% of total length (98 mm.); head rounded, about as broad as long (31×30 mm.); snout moderate (15 mm.), about twice diameter of eye (7 mm.), rounded when viewed from above, receding slightly in profile, extending very little beyond lip; canthus rostralis short, rounded and indistinct; lores with concave groove behind nostrils which are protuberant, sloping upwards obliquely and inwards from jaw to canthus rostralis; interorbital width considerably greater than the width of an upper eyelid (11 to 7 mm.), the top of the head shallowly concave with the eye bulges not very distinct; internal space 6.5 mm.; diameter of eye 70% of its distance from nostril; tympanum very distinct, directed slightly upward, diameter only slightly less than that of eye (6.5 to 7 mm.), distance from eye 3 mm.; a moderately well-defined supratympanic fold extending to above shoulder.

Skin above smooth with minute pitting; chin and throat fairly smooth; ventral surface from level of forelimbs and underside of thighs coarsely and rather uniformly granulate; both limbs except for thighs smooth below; no fold across breast; no anal flap.

Forelimb strong and fairly long (66 mm.), 67% of length of head and body; hand 30 mm.; finger discs well developed, narrower than long, exactly same size as tympanum (5×7 mm.); fingers in order of length, 1,2,4,3; extent of webbing between fingers, 52, 50 and 56%, fingers fringed; subarticular tubercles distinct, large and rounded; palmar area divided; thumb with large pad.

Hindlimb moderately strong, long, length (172 mm.) 176% of head and body; femur 52 mm., tibia 50 mm., foot 70 mm.; heel reaching to tip of snout; toe discs well developed, narrower than long, smaller than tympanum (4×4.5 mm.); toes in order of length, 1, 2, 3, 5, 4; extent of webbing between toes, 70, 70, 71 and 61%, all toes distinctly fringed to discs, webbing reaching discs of 1st and 5th toes and outer side of 2nd; subarticular tubercles rounded, distinct and of moderate size; sole smooth without supernumerary tubercles; inner metatarsal tubercle large, no outer tubercle.

Vomerine elevations paired, separated by nearly half the width of one of them, prominent and jutting out in ridges, posterior sides in a straight line each bearing about six small teeth, triangular and totally contained between lines joining the anterior and posterior edges of the choanae, which are large and oval, each being about half again the width of a vomerine elevation; tongue subcircular, slightly nicked behind, sides and front with a few shallow indentations; no subgular sac.

Dorsal colour bluish in alcohol, yellowish-white below; a white line 2 mm. wide, which is continued from along the margin of lower jaw, extends backwards to above forelimb where it ends abruptly.

Specimens examined and Locality Records: 8 (R.3513-5, A.M.) Mapoon, Gulf of Carpentaria, Q. (C. Hedley), 1903; 1 (R.4615, A.M.) New Guinea (Geog. Soc.'s Exped.), 1885; 1 (R.5246, A.M.) New Guinea (A. Morton); 1 (R.6650, A.M.) Herbert River, Q. (T. Steel), 14.iv.1914; 1 (R.6848, A.M.) Sorong, Dutch New Guinea (M.C.Z.), Feb., 1916; 1 (R.8899, A.M.) Aitape, New Guinea, 1.xii.1925; 1 (R.9574, A.M.) Papua (C. T.

McNamara); 1 (R.9877, A.M.) Inamatura, Mt. Lamington, Papua (C. T. McNamara), Apr., 1929; 1 (R.10474, A.M.) Trobriand Is. (J. Vogan), 15.ix.1931; 1 (R.11819, A.M.) Aitape, New Guinea (A. J. Marshall) 23.v.1936; 2 (R.11877-8, A.M.) Aitape, New Guinea (A. J. Marshall), 2.xi.1936; 1 (R.12222, A.M.) near Rabaul, New Britain (W. H. Harrington), 1937; 2 (R.12499, R.12521, A.M.) Bulolo, New Guinea (C. Gunther), 1940; 3 (R.13269-71, A.M.) Lae, New Guinea (E. L. Troughton), 17.viii.1947; 2 (R.13867, R.14544, A.M.) Laloki River, New Guinea (L. J. Jones), 1955; 6 (R.940-1, R.3004-7, A.M.) no data; 2 (J.5281, J.5285, Q.M.) Palm Island, Q.; 1 (D.3286, N.M.) Cairns, Q.; Sorong, Ternata Id., Manokwari, Merauke, Karakelang Id., Aitape, Finschhafen, Gusiko (Kalueng River), Hollandia, Toem, Liki Id., and Sansapor, vide Loveridge (1948:402); Katow, New Guinea, type locality of *Litoria guttata*, vide Macleay (1878:137); Sattelberg, New Guinea, vide Lonnberg (1900:580); Misol Island, Duke of York Island, Cape York, vide Boulenger (1882:384-5); Amboina Id., Molucca Islands, type of *dolichopsis*, vide Cope (1867:204); Halmahera Id., Molucca Islands, type of *dolichopsis* var. *tenuigranulata*, vide Boettger (1895: 136); Dinawa, Owen Stanley Mts., N.G., type of *spengleri*, vide Boulenger (1912:215).

All A.M., Q.M., and N.M. specimens, except R.3004-7, have been examined.

Variation.—Thirty-four specimens have been examined, of which 14, and possibly 16, are from the mainland. *Infrafrrenata* is a much larger and more rangy species than *caerulea* and its coloration is quite different. Most attention has been paid to the Australian frogs, and it is possible that an island *H. i. militaria* (Ramsay) has been included. The upper jaw is plain in all specimens and the wide, very prominent, white line which circles the lower jaw and then runs back from the angle to above the shoulder is always present and diagnostic. The dorsum is normally bluish in alcohol, but occasionally greenish or brownish, while in R.3514 it is purple. The back may be smooth without pores, or finely or coarsely shagreened. The surface of the chin and throat is granulate with the remainder of the ventral surfaces of body and thighs very coarsely granulate; behind the vocal sac it may be almost tessellated. The sides are never spotted like *caerulea* but some white extends from the ventral surface onto the shagreened area. Tympana are light and distinct. A white or pink line is prominent on the postaxial edge of the tarsus from the heel well along the 5th toe, and there is a similar line along the forearm and hand. It may be denticulated in blue from the dorsal surface. The pattern is not very conspicuous in juveniles. Males have large external vocal sacs opening into the mouth by long slits on each side of the tongue. Forelimbs may reach 80% of the length of head and body, and hindlimbs 200%. The heel reaches the tip of the snout or beyond. The vomerine elevations are robust, mainly transverse but a little oblique, and between the choanae in adults. They are well separated in all specimens except R.11819, where they are contiguous. They are small in R.13270 and small and rounded in juveniles. The largest finger disc is equal to the tympanum in size in all cases except three, when it is slightly smaller. The largest specimen seen, R.11819, measured 127 mm.

Discussion.—I am indebted to Nieden for much of the New Guinea and islands synonymy. *Infrafrrenata* is quite distinct from other mainland frogs which are the main concern here. Boulenger (1882: 384) describes *dolichopsis* in the form of a comparison with *caerulea* as follows: "Differs from *H. caerulea* in the following points: Snout longer, twice as long as the diameter of the eye; fingers half webbed; disks larger, considerably larger than the tympanum; hind limb much longer, the tibio-tarsal articulation reaching the tip of the snout, or beyond. Skin of head and scapular regions not, or but very slightly, thickened, without large pores. Lower lip with a white, below brown-edged, margin; a white streak along the outer edge of forearm and tarsus. Size larger, from snout to vent 115 mm. Austro-Malaysia." He next (p. 385) says of *infrafrrenata*: "Agrees in every respect, in coloration as well as in structural characters, with *H. dolichopsis*, but the digital disks are much smaller than the tympanum. From snout to vent 45 mm. North Australia. Cape York (Type)." It should be noticed that Boulenger's specimen of *infrafrrenata* was only young. Both Kinghorn and Loveridge have noted that the tympanum has a higher growth rate than

the eye. Boulenger (1885: 387) thought that *De Vis' irrorata* should be compared with this species. This was discussed by Fry (1912: 100) and also under *irrorata* in the present paper. Later Fry (1913: 49) examined the type specimen of Macleay's *Litoria guttata* from Katow, New Guinea, and concluded that it was without doubt an extremely young example of *infrafrenata*. Lonnberg (1900: 580) noted that a young specimen lacked vomerine elevations, and redescribed a large individual. Nieden (1923: 205) gives a redescription of the adult and the tadpole. Loveridge (1948: 402), who had about 50 specimens, gives a detailed discussion of taxonomy, diagnostic characters, relative eye and tympanum sizes, colour in life and habitats when collected. *Infrafrenata* has a three months' priority over *dolichopsis*—from June to September, 1867.

HYLA IRRORATA De Vis.

Synonymy and references: *Hyla irrorata*: De Vis (1884:128); Boulenger (1885:387); Fry (1912:100); Loveridge (1935:39).

De Vis's original description (1884:128) reads: *Hyla irrorata*. Vomerine teeth in two small, rather distinct groups behind the choanae; tongue a broad oval, notched on its free hind edge; head much broader than long; snout truncated; nostrils much nearer to the tip of the snout than to the eye; tympanum two-thirds to three-fourths of the eye; fingers broad, webbed at the base, disks two-fifths of the tympanum; toes two-thirds webbed, the web reaching the disks of the third and fifth and fringing the fourth, which is short; two metatarsal tubercles, the outer small; skin smooth above, granulated beneath, more coarsely on the abdomen. Lead-blue to olive-brown; beneath rufous or buff—in young examples, paler on the throat and purplish on the under and hinder surfaces of the thighs; on and behind the angle of the mouth a short line, or series of spots, white; a spot on the arm (nearly constant), and a line along the hinder edge of the forearm white; a group of small white spots on the groin, sometimes extending round the coccyx; occasionally a few scattered white dots on the back, and a large one on each side of the throat.

Measurements.	Lines.	Lines.	Measurements.	Lines.	Lines.
Total length	32	20	Hindlimb	42	28
Length of head	8	6½	Hindfoot	19	13
Length of snout	4	3	Forelimb	17	11
Interorbit	9	5¾	Forefoot	8	5¾

Locality, Gympie. Collected by Mr. H. F. Wallmann.

Description of J.9255 in the Queensland Museum, an adult female, Dalby, Queensland:

Habitus slender but with a broad head; total length of head and body 36 mm.; head pentagonal with parallel sides and very prominent snout, as broad as long (12.5 mm.); snout moderate (6 mm.), one and a half times diameter of eye (4 mm.), bluntly rounded between nostrils but made conspicuous by the horizontally concave loreal region, almost straight but receding slightly in profile, extending very little beyond lower lip; canthus rostralis short, a trifle concave, hardly angular but distinct; lores concave horizontally, sloping upwards obliquely; interorbital width 1.6 times that of an upper eyelid (4.5 to 2.75 mm.), the top of the head flat between very prominent eye bulges; internasal space 3.25 mm.; diameter of the eye slightly greater than its distance from nostril; tympanum very sharply outlined, directed slightly upward, contained in diameter of eye one and a third times (3 to 4 mm.), distance from eye 1.5 mm.; a thin but most distinct supratympanic fold from eye to shoulder overhanging tympanum.

Skin almost smooth in general appearance, but minutely pitted all over, particularly on head, upper eyelids and forepart of body; limbs practically smooth; chin except for smooth margin, throat, and underside of body and thighs granular; otherwise limbs smooth including posterior surfaces of thighs which do not have a granular extension up to vent; a narrow pectoral fold; a very small anal flap.

Forelimb moderately long (24 mm.), 67% of length of head and body; forearm without dorsal shield, and upper arm little thinner than the fairly robust forearm; hand 10 mm.; finger discs small, especially on thumb, rounded, largest two-thirds

diameter of tympanum (2 to 3 mm.); fingers in order of length, 1,2,4,3; extent of webbing between fingers; 27, 37 and 33%; fringes practically absent; subarticular tubercles small, rounded, distinct; palm divided; thumb broadened basally.

Hindlimb moderately robust and long, length (54.5 mm.) 151% of head and body; femur 15.5 mm., tibia 16 mm., foot 23 mm.; heel reaches to about nostril; toe discs distinct but small, about half diameter of tympanum (1.5 to 3 mm.); toes in order of length, 1,2,3=5,4; extent of webbing between toes, 36, 44, 61 and 61%; no toe webbed to disc; narrow fringes to all discs; subarticular tubercles rounded and distinct; sole divided, fairly smooth; a narrow tarsal fold; an elongated inner metatarsal tubercle, and a low, rounded outer one.

Vomerine elevations paired, well separated, oblique, each about the size of one of the rather large choanae, almost but not quite behind choanae; tongue subcircular, free and slightly indented behind.

Dorsal surfaces brownish-blue in spirit, brownish on limbs; all ventral surfaces whitish except for brownish margin of lower jaw and a few brown speckles on underside of toes; the brown colour extends along upper arm and thigh to form a brown area about vent; a strongly contrasted white discontinuous line begins under the eye and runs along the upper jaw, under the tympanum and to the shoulder; this white line resumes behind the forelimb and continues more than half way along the side in the form of about four, large rounded or lens-shaped, partly confluent, patches; above this there are altogether about a dozen quite small white spots; a white line along outer edge of forearm, tibia and tarsus; a large white spot on the upper arm.

Specimens examined and Locality Records: 1 (J.9255, Q.M.) Dalby, Q.; Gympie, Q., type locality, vide De Vis (1884:128).

Discussion.—This species stands close to *gracilentia*, and the only specimen examined is labelled as such in the Queensland Museum collections. It is at once separated from *gracilentia* by the conspicuous, quite wide stripe back from the upper jaw over the shoulder and its prolongation along the side as large, blob-like white spots. Again, *irrorata* has a very distinct tympanum, and lacks the light line along the canthus rostralis and behind the eye rather dorsally as well as the shield on the forearm of *gracilentia*. De Vis's description (1884:128) is quite diagnostic when a specimen is before one. Minor points of difference drawn from his frogs from Gympie, which is about 120 miles from Dalby, are probably a function of fresh material, such as when he says the head is much broader than long and that the web reaches the discs of the 3rd and 5th toes. He also mentions that the finger discs are two-fifths of the tympanum. The largest discs of J.9255 are two-thirds the diameter of the tympanum, but these are about twice the size of those of the thumbs. In all J.9255 conforms faithfully to the original description. Boulenger (1885:387) strongly criticizes De Vis' work and sinks nearly all his species described in 1884 in synonymy. He says "*Hyla irrorata* should be compared with *H. infrataeniata*, Gthr." Fry (1912:100) discusses *irrorata* quite fully, but did not have a specimen before him. He points out that Boulenger doubtless meant *H. infraenata* Günther and not *H. infrataeniata* Gthr. On the grounds of coloration, the disposition of the vomerine elevations and geographical distribution, Fry decided that *irrorata* could hardly be a synonym of *infraenata* and suggested that it was a synonym of *H. caerulea*. He says: "In the presence of a white mark behind the angle of the mouth it agrees with *H. infraenata* and differs from *H. caerulea*, but in the occurrence of irregular white spots on groin and upper surfaces it possesses a character which is typically characteristic of *H. caerulea*." *Irrorata* differs from both *caerulea* and *infraenata* in the amount of webbing and the size of the discs as well as other characters. Fry mentions that the type has been lost. Loveridge (1935:39) follows Fry in referring *irrorata* to the synonymy of *caerulea*.

HYLA PERONII (Tschudi).

Synonymy: *Dendrohyas Peronii*; Tschudi (1838: 75); Fitzinger (1860: 413). *Hyla peronii*; Duméril and Bibron (1841: 569); Günther (1858: 112; 1863: 250; 1867: 56); Krefft (1864: 389; 1865: 18; 1866: 33); Steindachner (1867: 60); Keferstein (1868b:

282); Boulenger (1882: 390; 1885: 387); Fletcher (1889: 365, 370, 381; 1890: 670-5; 1891: 265, 272-3; 1892: 8, 12; 1894: 524, 528-530; 1898: 665, 669, 681-2); Spencer (1892: 21); Lucas (1892: 61; 1896: 47); Fry (1912: 99); Andersson (1913: 21; 1916: 15); Nieden (1923: 224); Chisholm (1925: 62); Kinghorn (1931: 89) Loveridge (1935: 41); Mitchell (1955: 404). *Hyla rothii*: De Vis (1884: 66); Fletcher (1898: 682); Fry (1912: 99).

Tschudi's original description (1838: 75) gives little more than the first publication of the name and reads: *Dendrohyas Peronii* (Nov. Holl.). Syn. *Hyla Peronii* Bibr.

Description of No. A.C.4650, an adult male, Poison Point Bore, about 53 m. W. of Bourke, N.S.W., 3.i.1951:

Habitus, a moderately robust species with a rather broad head, width of body (22 mm.) 41% of total length of head and body (54 mm.); head bluntly pointed, as broad as long (17.5 mm.); snout short (8 mm.), 1.6 times diameter of eye (5 mm.), obtusely pointed when seen from above, rounded in profile, noticeably overhanging lower lip; canthus rostralis rounded and indistinct; lores gently concave, but in general flattish and sloping obliquely upwards and inwards to canthus rostralis; interorbital width markedly greater than that of an upper eyelid (7 to 4 mm.), top of head flat between prominent eye bulges; internasal space 4.5 mm.; diameter of the eye exactly equals its distance from nostril; tympanum round, very distinct, directed markedly upwards, contained in diameter of eye 1.4 times (3.5 to 5 mm.), distance from eye 1.75 mm.; a distinct supratympanic ridge made very conspicuous by the inward-turned tympanum.

Skin uniformly rough and studded with larger and smaller low, rounded warts; chin and throat granular; belly and lower surfaces of thighs with an area up to the vent coarsely granulate; limbs otherwise smooth; a prominent pectoral fold; anal flap very small.

Forelimb strong and moderately long (31 mm.), 57% of length of head and body; hand 16 mm.; finger discs well developed, rounded, perhaps a shade smaller than tympanum (3.25 to 3.5 mm.); fingers in order of length, 1, 2, 4, 3; extent of webbing between fingers, 40, 53 and 58%; practically no fringing; subarticular tubercles large, rounded and prominent; palm divided with a few large flat tubercles; thumb, which is partly opposed to the other fingers, with a large pad.

Hindlimb moderately robust and long, length (89 mm.) 165% of head and body; femur 26 mm., tibia 27 mm., foot 36 mm.; the heel reaches to nostril; toe discs well developed, rounded, smaller than tympanum (3 to 3.5 mm.); toes in order of length, 1, 2, 5, 3, 4; extent of webbing between toes, 75, 85, 88 and 87%, webbing to discs or nearly so, except on preaxial sides of three middle toes where there are narrow fringes; subarticular tubercles prominent, projecting and rounded; sole granular, inner metatarsal tubercle large (2 mm.), oval, no outer tubercle.

Vomerine elevations paired, slightly elliptical, transverse, well separated and even more widely separated from the much smaller choanae, prominent and strongly projecting, mainly between and in front of the choanae, but because of the smallness of these openings a very small part may be behind a line joining the posterior margins of the choanae; tongue subcircular, free and feebly grooved behind, large but somewhat narrower than mouth at angle of jaws; the large subgular vocal sac has a moderately sized opening into the mouth at each side of the tongue; when deflated it is bounded by two well-marked transverse folds, the posterior being the pectoral one, and there is another oblique fold joining the two transverse ones on each side just in front of the insertion of the forelimb.

Colour above reddish-brown with irregular black mottling; ventral surfaces yellow except for chin and throat which are heavily suffused with dark brown; rear of thighs yellow irregularly blotched with black in patches and scriptiform markings; this excludes a large patch spotted with white and brown below the vent; flanks marked somewhat as posterior surfaces of thighs; limbs dorsally obscurely cross-barred with darker; there is an irregular line of granules picked out in whitish yellow behind the forearm and another behind the tarsus extending along the 5th toe; the tympanum is light yellowish-brown and very distinct.

Specimens examined and Locality Records: 1 (R.1242, A.M.) Richmond River, N.S.W.; 1 (R.1870, A.M.) Colo Vale, N.S.W. (N. Etheridge), Nov., 1895; 1 (R.2399, A.M.) Pambula, N.S.W. (Mrs. Forde), Oct., 1898; 1 (R.2928, A.M.) Eidsvold, Q. (T. L. Bancroft), Sept., 1912; 1 (R.3385, A.M.) Marrickville, Sydney, N.S.W. (Henry Selkirk), Apr., 1902; 12 (R.3516-3524, R.3526, A.M.) Mapoon, Gulf of Carpentaria, Q. (Chas. Hedley), July, 1903; 1 (R.3838, A.M.) Parramatta, N.S.W. (A. R. McCulloch); 1 (R.4253, A.M.) Warrell Creek, Nambucca River, N.S.W. (Dene Fry), Nov., 1908; 4 (R.4295-8, A.M.) Darling River, N.S.W. (R. Helms), May-June, 1890; 1 (R.4381, A.M.) Brisbane, Q. (A. R. McCulloch); 2 (R.4633-4, A.M.) Warrell Creek, Nambucca River, N.S.W. (W. Clark), Jan., 1910; 3 (R.4660, R.4662-3, A.M.) Woonona, near Bulli, N.S.W. (H. L. Coleman), Feb., 1910; 1 (R.5011, A.M.) Cape York, Q. (C. Hedley and Elgner), Dec., 1910; 1 (R.5348, A.M.) Eidsvold, near Gayndah, Q. (T. L. Bancroft), Aug., 1911; 2 (R.5444-5, A.M.) Buddah Lakes, Trangie, N.S.W. (J. Woodhead), Dec., 1911; 1 (R.5864, A.M.) Brisbane, Q. (McCulloch and Troughton), Sept., 1912; 1 (R.5895, A.M.) Nambucca River, N.S.W. (H. E. Smart), Sept., 1912; 5 (R.5925-8, R.5983, A.M.) Eidsvold, Q. (T. L. Bancroft), Sept., 1912; 1 (R.6543, A.M.) East Maitland, N.S.W. (L. Harrison), Jan., 1914; 8 (R.6651-4, A.M.) Herbert River, Q. (T. Steel), 14.iv.1914; 2 (R.6942-3, A.M.) Townsville, Q. (F. H. Taylor), 15.iii.1916; 2 (R.7340-1, A.M.) Goangra, near Walgett, N.S.W. (J. J. Fletcher), Nov., 1921; 3 (R.7345-6, A.M.) Emu Plains, Urana, near Narrandera, N.S.W. (J. J. Fletcher), Nov., 1921; 5 (R.7358-62, A.M.) Narrabri, N.S.W. (J. J. Fletcher), Nov., 1921; 1 (R.7472, A.M.) Mt. Wilson, Blue Mts., N.S.W. (J. J. Fletcher), Feb., 1922; 3 (R.7528-30, A.M.) Lower Clarence River, N.S.W. (J. J. Fletcher), Feb., 1922; 3 (R.7964, R.7966-7, A.M.) Upper Colo, N.S.W. (Kinghorn, Fletcher and Wright), Oct., 1922; 2 (R.8092-3, A.M.) Bulahdelah, N.S.W. (H. L. Kesteven), Oct., 1923; 2 (R.8347-8, A.M.) Mt. Horeb, Tumut Dist., N.S.W. (J. H. Wright), Aug., 1924; 3 (R.9394-6, A.M.) Coolong, near Yerranderie, N.S.W., 15.xii.1927; 1 (R.9408, A.M.) Jaffa, Ashford Downs, N.S.W. (B. Morrisby), Dec., 1927; 3 (R.9725-7, A.M.) Groote Eylandt, N.T. (W. E. Warren), 9.i.1929; 4 (R.10690-3, A.M.) Tubbo Stn., Murrumbidgee Area, N.S.W. (Kinghorn, McKeown and Barnes), 1932; 2 (R.10694-5, A.M.) Marsh, 10 m. W of Narrandera, N.S.W. (K. M., and B.), 1932; 36 (R.10696-R.10725, R.10704-16, R.10718-25, A.M.) Five Bough Swamp and Canal, Agricultural High School, Yanco, N.S.W. (K., M., and B.), 1932; 1 (R.11020, A.M.) Groote Eylandt, N.T. (H. J. Perryman); 1 (R.11354, A.M.) Alexandra Stn., N.T. (Troughton and Fletcher), 6.vi.1934; 21 (R.11600-2, A.M.) Pilliga, N.S.W. (S. Benney), July, 1935; 2 (R.12078-9, A.M.) Palmdale, Wyong, N.S.W. (J. H. Wright), 1937; 1 (R.12744, A.M.) Lowana, N.S.W. (Mel. Ward), Dec., 1943; 4 (R.13387-8, A.M.) Bowenfels South, N.S.W. (Kinghorn and MacKay), Feb., 1948; 4 (R.13587-8, A.M.) Cape Arnhem, N.T. (J. E. Bray); 1 (A.4913, A.M.) Yam Creek, N.T. (O. C. Morton), 1879; 9 (6901, 7121, 7124, 7334, 7336-40, A.M.) no data; 1 (7116, A.M.) Mulgoa, N.S.W. (Dr. Cox); 1 (J.397, Q.M.) Tambourine Mt., Q.; 1 (J.651, Q.M.) Eidsvold, Q.; 2 (J.1327-8, Q.M.), Brisbane, Q.; 1 (J.2549, Q.M.) Gyranda, Q.; 1 (J.6215, Q.M.) Beechmont, Q.; 1 (D.3258, N.M.), Gunbower, V.; 1 (D.6855, N.M.), Bruthen, V. (D. Barling), 3.i.1918; 1 (D.7015, N.M.) Sydney, N.S.W.; 1 (D.7855, A.M.) Kerang, V. (A. Burns); 1 (D.8834, N.M.) N.S.W.; 1 (R.2635, S.M.) Murray Bridge, S.A. (T. H. Johnson), 2.ii.1948; 5 (R.3735, S.M.) St. George, Q. (W. Hosmer), 25.ix.1955; 6 (R.3898, S.M.) Taillem Bend, S.A. (T. H. Johnson), 23.ii.1942; 1 (A.C.123) Colo, N.S.W., 18.ix.1938; 2 (A.C.128-9) Upper Cordeaux Dam, N.S.W., 25.ix.1938; 1 (A.C.191) Yarramalong, N.S.W., 23.x.1938; 2 (A.C.221-2) Rouse Hill, N.S.W., 5.xii.1938; 4 (A.C.353, 357, 360, 362) Rouse Hill, N.S.W., Feb., 1939; 2 (A.C.5434) Condamine Downs, Q., 2.xi.1939; 1 (A.C.2261) Putty, N.S.W., 24.v.1944; 1 (A.C.3977) McIntyre Brook, near Whetstone, Q., 11.i.1948; 9 (A.C.4648-4656) Poison Point Bore, 53 m. W. of Bourke, N.S.W., 2.i.1951; 1 (A.C.4660), 7 m. E. of Poison Point Bore, N.S.W., 3.i.1951; 1 (A.C.4837) Tocumwal, N.S.W. (I. M. Watts), 1.xi.1951; 1 (A.C.5109) Warra, Q., 29.xii.1954; 3 (A.C.5125-6, 5143) Jandowae, Q., 30.xii.1954; 8 (A.C.5235-40, 5255-6) Baralaba, Q., 7.i.1955; 1 (A.C.5384) 8 m. S.E. of Calliope, Q., 12.i.1955; 2 (M.C.Z.1602) Melbourne, V. (Prof. F. Müller); 1 (M.C.Z.1928) Sydney, N.S.W. (Göttingen Mus.), 1885; 1 (M.C.Z.3587)

Woonona, near Bulli, N.S.W. (Australian Mus.), 1914; 1 (M.C.Z.3588) Eidsvold, Q. (Australian Mus.), 1914, last four localities vide Loveridge (1935:41); 4 (U.S.N.M. 128715-8) Oenpelli, N.T., vide Mitchell (1955:404); Port Essington, Rockhampton, Long Bay, Sydney, vide Boulenger (1882:391); Comboyne Plateau, N.S.W., vide Chisholm (1925:62); Illawarra, Burrawang, Blue Mts., Coolah, Guntawang, Cullenbone, Dandaloo, Hay, Wagga, Goangra, Euroka, near Condobolin, Urana, Lower Clarence and Tamworth, all in N.S.W., vide Fletcher (see synonymy).

All 227 A.M., Q.M., N.M., S.M., and A.C. specimens listed have been examined.

Variation.—Proportions of the head are very constant, being about equal or a little longer than broad. The length of the snout is usually from 1.4 to 1.6 times the diameter of the eye. Occasionally it may be very slightly less, especially in specimens such as J.1328, where the snout is truncate when seen from above. The snout is sometimes virtually vertical and then only projects a little beyond the lower lip. The interorbital width, which is generally much more than that of an upper eyelid, may reach twice its width; but in an odd case, such as A.C.357 and A.C.360, sinks to unity. This is most noticeable in frogs from the central coastal area of N.S.W., where the eye bulges are very prominent and encroach on the interorbital space. Northern specimens have smaller and lower upper eyelids. The tympanum is slightly larger in eastern coastal N.S.W. specimens than in those from Queensland and the west of N.S.W. The skin is always dorsally and laterally studded with warts, almost invariably rounded, but a few may be lenticular. The warts vary a good deal in height, some being very low. A few specimens, such as J.397 from Tambourine Mountain, are extremely warty and may be said to be shagreened especially on the sides. In six of ten western N.S.W. and half the Queensland specimens examined the largest finger disc equalled the size of the tympanum. The respective averages were 94% size of the tympanum and 91%. This occurred only once in 11 eastern N.S.W. individuals (average 84%), but the variation may be attributed to the different sizes of the tympanum as noted above. The percentage of webbing between the 3rd and 4th fingers in 38 A.C. specimens averages 52 ± 1.3 . The majority are thus fairly closely grouped. Frogs from the central coast of N.S.W. have smaller webs, averaging 48% against 55% for those from the Far West of the State. Length of the hindlimb is slightly shorter in western N.S.W. frogs, its proportion to head and body length being 168% against 172% for eastern N.S.W. and 177% for Queensland specimens. The extent of webbing between the toes is fairly constant. The heel reaches the snout or slightly beyond in three frogs out of four. Vomerine elevations are large, transverse, well separated, partly in front of the choanae and in some cases a trifle behind because the choanae are small, much as in A.C.4650, in 71 of the 166 A.M. frogs. They are smaller and rounded in the remainder. Excluding those without locality records, the N.S.W. specimens represent 84% of those with robust vomerine elevations against 16% from Q. and the N.T. N.S.W. frogs only amount to 74% of all specimens in both classes, so there seems to be a decided tendency for southern individuals to have more strongly developed elevations. This is supported by the specimens in the author's collection. Of 38, 28 are rounded, well separated and between the choanae, 10 are of the larger and more robust type. Seven of these 10 are from the coastal area of N.S.W. (7 out of a total of 11 from this area), two of the others are from western N.S.W., but only one, A.C.5125, from Queensland. J.6215 is abnormal in having the right elevation missing. The tongue is always much narrower than the mouth and may be quite elongated. Seven frogs from Murray Bridge and Tailm Bend have the vomerine elevations very small and rounded, the choanae slightly larger than usual, the dorsum practically smooth, and the posterior surfaces of the thighs white with much smaller and more scattered black spotting than normal. The black markings on the back are generally without any suggestion of pattern, but in a Mt. Tambourine, a Groote Eylandt and four Cape Arnhem frogs there is a longitudinal arrangement. Black blotching on yellow behind the thighs is typical. It may often be very bold, the pattern varying from as many as a dozen blotches to as few as two very prominent ones. This very bold pattern occurs in about 9% of frogs and does not follow any geographical lead. In A.C.191, A.C.2261 and D.7015 there is so much black behind the thighs that the yellow is reduced to a few islands. Western N.S.W.

frogs all have a few large black markings on bright yellow, except A.C.4656, where the posterior surfaces of the thighs are uniform yellow but for a few, small, irregular spots. A.C.4837 from Tocumwal is greyish dorsally with small black spots; a blackish line from the eye curving over the tympanum and shoulder to become a series of black spots. The thighs have round spots below an interrupted dorsolateral line. R.9395 also has the black supratympanic line. The flanks are marked much as the posterior aspect of the thighs. White spots in series behind the forearm and tarsus are always present, but vary greatly in prominence. No frogs are quite smooth and the wartiness is generally fairly evenly distributed. Some old individuals are extremely warty.

Discussion.—Günther (1863: 250) gives a very good account of colour and colour changes in life, mentioning the typical bright yellow with “irregular reticulated black spots” of the posterior surfaces of the thighs and loins; and blackish-brown and small green dots on the brownish-olive back when awake. Asleep the ground colour becomes lighter, the dark spots disappear, the green dots become indistinct, and the tubercles turn whitish at the tip. He also refers to feeding and other habits and voice. Keferstein (1868b: 282) gives a concise but diagnostic description. Günther (1858: 112) gives the only record of this species from Tasmania—a female presented by Sir A. Smith. This record has never been supported. Boulenger only repeats Günther’s record, as does Fletcher (1898: 665). The frog is almost certainly *burrowsi*. Lucas (1896: 47) reports *peronii* from north-west Victoria. There seems no doubt from the original description that De Vis’ *rothii* (1884: 66) is a synonym of *peronii*. It was based on four specimens from Mackay. Boulenger (1885: 387) strongly criticized De Vis’ work and placed *rothii* in the synonymy of *peronii*. Eight specimens in the Australian Museum from the Herbert River are tagged “*v. rothii*” and fall perfectly well within the range of *peronii*. Fletcher (see synonymy) has about 24 references to the species dealing with breeding and other habits and distribution. He discusses (1898: 669) the difficulties of describing webbing and of using it as a diagnostic character. Nieden (1923: 224) follows Boulenger (1882: 390) fairly closely, but notes that the snout may be slightly longer than the orbital diameter, the interorbital space broader than an upper eyelid, and several other small differences. Chisholm (1925: 62) describes a frog from the Comboyne Plateau as biscuit-coloured with punctiform markings of green all over its dorsal surface and with orange yellow and black thigh markings. Mitchell (1955: 404) says that his frogs from Tailem Bend, S.A., are not distinguishable from northern and eastern Australian specimens except for a darker and more variegated colour pattern. Frogs are much more brightly coloured in life than would be suspected from museum specimens. Dorsal surfaces may be yellowish, brownish, reddish, or ash or silver grey. There are often vivid green dots or ovals, and jet black dots on the back. The underside may be creamy pink, pale pink, a deep clear yellow, and there is not uncommonly much rusty red. Andersson (1913: 21) reports six specimens from the Kimberley Division, Jedda, and Noonkambah in the St. George Range, all in Western Australia. He considered naming them as a separate race on the grounds of the snout being considerably longer than the orbit, the interorbital space much broader than the upper eyelid, and the vomerine elevations small, rounded, and smaller than the choanae, but because of the “great variation of this species” did not do so.

HYLA BURROWSI Scott.

Synonymy and references: *Hyla peronii* (non Tschudi): Günther (1858: 113); Boulenger (1882: 391); Krefft (1866: 18-20: 1869: 93); Fletcher (1898: 665); Lord and Scott (1924: 101); Loveridge (1934: 56). *Hyla burrowsi*: Scott (1942: 5, 7).

Scott’s original description (1942: 7) reads: *Hyla burrowsi*, sp. nov. (Plates I-III). ? *Hyla peronii* Günther (non Duméril and Bibron), Cat. Batr. Sal. Brit. Mus., 1858, p. 113 (adult Tasmanian specimen, presented by Sir A. Smith, only). ? *Id.* Boulenger, Cat. Batr. Sal. S. Ecaud. Brit. Mus., 1882, p. 390 (same Tasmanian specimen only). Diagnosis. A medium-sized, slender, non-litorian *Hyla*, entering subsection B, 2, a, β in key to Australian species of the genus by Boulenger (1882, p. 347). Distinct web

between fingers. Head longer than broad. Tongue subcordate. With hindlimb adpressed, tibio-tarsal articulation reaches nostril, or between nostril and eye. In alcohol, above green, with or without greyish, or greyish and dark bluish, marblings: below whitish or pale brownish, immaculate, except for part of throat, which is greenish, marbled with grey: hinder aspect of thigh brownish, immaculate, or with a few obsolescent whitish spots. Description. Size moderate; habit rather slender, non-litorian. Tongue subcordate, somewhat constricted at about its anterior one-fourth with formation of a rather narrow lobe, shallowly nicked where it overlies mandibular symphysis; free, and very slightly, or slightly, nicked behind (Plate III, fig. 3). Vomerine teeth in two suboval series between choanae, the tooth-line on a level with, or slightly behind, level of choanae. Teeth-series a little oblique, convergent posteriorly; contiguous (female; Plate III, fig. 2) or separated (male; Plate III, fig. 1) by from one-half to two-thirds of width of one group: each series with about 7-9 mostly closely set, rather blunt, subtuberculate, slightly recurved teeth (Plate III, fig. 4). Head moderate, 2.4-2.5 in total length; 1.2-1.3 times as long as broad. Snout rounded; profile squarish, anterior profile nearly vertical, gently convex; 4.3-4.4 in head; 1.1-1.2 times eye, subequal to orbit. Canthus rostralis straight; angular and very distinct (male), or rather rounded, only moderately distinct (female). Loreal region oblique, concave. Interorbital space flat; measured between bases of ocular capsules, interorbital 1.4-1.6 times eye, slightly exceeding length of upper eyelid; measured between anterior canthi, 2.3-2.4 times eye. Direct distance from nostril to eye less than diameter of eye, slightly greater than internarial distance. Tympanum distinct (female), or fairly distinct (male); about half eye. Forearm 1.0-1.1 in upper arm (axilla-joint), 5.1-5.3 in total length. Hand (Plate III, fig. 5) rather slender. No distinct rudiment of pollex. Fingers with distinct web. With digits, in sequence from preaxial border of limb, designated I (pollex), II, III, etc., and phalanges, in sequence from proximal phalanx, i, ii, iii, etc., and with extent to which phalanx is webbed indicated by 1.0 (fully webbed), 0.5 (one-half webbed), and so on, a quantitative expression of the webbing is given by the formula: II i, 1.0 and III i, 1.0: III i, 1.0 and IV i, 0.0 (one specimen 0.1): IV i, 0.1 and V i, 0.3. Hence average extent of webbing is 0.6 of phalanx. The separation, in their distal one-third, of metacarpals relating to digits IV and V admits of the formation here of a web with depth exceeding half eye-diameter. With adjacent digits adpressed, tip (including disk) extends: II to III ii, 0.3: III to IV ii, 0.5: V to IV ii, 1.0. Disks larger than those of toes, three-fifths eye. Subarticular tubercles prominent. A very strong transverse fold on wrist. With hindlimb adpressed to body, tibio-tarsal articulation reaches nostril, or between nostril and eye. Thigh (groin-joint) 1.1-1.2 in lower leg, which is 1.9-2.0 in total length. Foot (Plate III, fig. 6) fairly broad. Toes strongly webbed: I ii, 0.5 (one specimen 0.9) and II i, 1.0; II i, 1.0 and III ii, 1.0 or 0.9: III iii, 0.5 (one specimen 1.0) and IV ii, 1.0 or 0.9: IV ii, 1.0 or 0.9 and V ii, 1.0 (one specimen 0.7). Hence average extent of webbing is 1.5-1.6 phalanges. Along preaxial border of II, III, IV web is continuous with narrow fringe extending to disk. From preaxial border of I i a distinct web runs to the (single) large metatarsal tubercle, which, standing out approximately parallel with the digit, functions as a pre-hallux: from tubercle, whose tip is just free of webbing, the web, continuing towards body, shortly merges into the well-developed tarsal fold. With adjacent digits adpressed, tip (including disk) extends: I to II ii, 0.5-0.6: II to III ii 0.7-0.8: III to IV ii, 0.9-iii, 0.1: V to VI ii, 1.0-iii, 0.5. A thin slip of ordinary integument, concolorous with that on dorsum of metatarsus, runs from near base of digit IV to outer margin of web between IV and V: a less distinct, smaller, elongately triangular slip, almost concolorous with web, on outer part of web between IV and III. Subarticular tubercles fairly prominent. Outer metatarsals fully united. Upper surfaces quite smooth, or with a few small scattered tubercles. Belly, chest, throat, underside of thighs granulate: chin smooth. Fairly strong fold from eye, over tympanum, to shoulder, where it meets a pronounced glandular fold from angle of mouth. More or less distinctly glandular lateral fold from axilla to, or nearly to, groin. Slight or moderate fold across chest. An apparently glandular region along postaxial border of forearm. Male with internal subgular sac.

There is considerable variation in the dorsal colour-pattern, particularly on the body (Plate II, figs. 1a, 2a, 3a). In alcohol, upper surface of head and body of female dark olive, immaculate; of male dark green, mottled, slightly on head, heavily in hinder one-third of body, with greyish; or dark bluish, with large irregular patches of green, most numerous on head, and with smaller, scattered whitish (in occipital region somewhat brownish) marblings. Excluding digits, upper surfaces of limbs of female olive, immaculate; an irregular yellowish streak along hinder edge of upper aspect of thigh: of male marbled with dark bluish and pale greyish, and with numerous largish green blotches. In hand digits II and III of medium brown, the latter digit slightly marbled proximally with lighter (in both sexes); IV and V, greenish with some fawn mottling distally in female; mottled whitish, and greenish or dark grey in male. In foot digit I brown, immaculate; II brown, moderately mottled with fawn: III brownish or dark grey, mottled with fawn: IV and V in female greenish, slightly mottled with fawn; in male dark bluish grey, heavily mottled with pale greyish. The green patches on upper surfaces of head, body, and limbs commonly have a somewhat lichenoid facies, suggestive of their being, as it were, plastered on. A narrow dark streak along canthus rostralis. From below eye to beyond angle of mouth a bright green, or yellowish green, region, which in female, but not in male, expands posteriorly to delimit hinder border of tympanum. From just behind tympanum to, or nearly to, groin a lateral band of dark, somewhat bluish grey, with numerous, generally longitudinally elongate, whitish spots, which may anastomose to form lines or reticulations: this band bordered above by an obscure stripe of green paler than that on back. Groin immaculate, pale brown or flesh-colour. Belly and chest light brownish: chin, and in female and in one male forepart of throat, greenish, mottled with greyish white (Plate II, figs. 1b, 2b, 3b). Lower surfaces of limbs chiefly yellowish flesh colour or pale brownish. No dark rugosities on digit II of males taken in January. Glandular region surrounding vent dark slate-grey, spotted with white or light brown: a very small reddish brown spot just above vent usually present. Hinder side of thighs light brownish or dark brown: immaculate, save for presence, in one male, of a few very small obsolescent whitish spots.

Types, described and figured from the holotype male (Q.V.M. Reg. No. 1941.41), 54.0 mm. in total length (snout-vent); the allotype female (Q.V.M. Reg. No. 1941.40), 50.0 mm. in total length; and a paratype male (Q.V.M. Reg. No. 1941.42), 51.5 mm. in total length. Donated by Miss M. Burrows, in whose honour the species is named. An additional specimen (Q.V.M. Reg. No. 1941.51), which was obtained by Miss Burrows in the gorge of the Fury River, Cradle Mount-Lake St. Clair Scenic Reserve, in January, 1940, and which escaped from captivity, to be found again some months later in a dried state, has also been examined.

Locality. Cradle Valley, Tasmania. Female and smaller male collected clinging to button-grass, *Gymnoschoenus sphaerocephalus* Bentham, on edge of small pond near Dove Lake, 7th January, 1941, approximate altitude 3100 feet: larger male from pond near Wombat Tarn, between Lake Lilla and Crater Lake, 15th January, 1941, approximate altitude 3300 feet.

Description of paratype No. R.12, 563, an adult male, Dove Lake, Cradle Valley, T., 7.i.1941 (Miss M. Burrows):

Habitus elongated with large head and rather narrow body, limbs well developed; total length of head and body 51 mm.; head subtriangular, somewhat broader than long (17.5 × 15 mm.); snout short (6.5 mm.), 1.2 times diameter of eye (5.5 mm.), rounded when seen from above, high and almost vertical in profile, projecting slightly beyond lower lip; canthus rostralis angular, distinct; lores oblique, slightly concave; interorbital width 1.3 times that of an upper eyelid (5 to 3.75 mm.), top of head flattish with very prominent eye bulges; internasal space 4 mm.; diameter of the eye a trifle more than its distance from nostril; tympanum rather small, indistinct, directed slightly upward, contained in diameter of eye exactly twice (2.75 to 5.5 mm.): a thick well-defined supratympanic fold continuing laterally to near groin.

Skin above fairly smooth with many quite small low tubercles; sides of body rough; chin, belly and undersides of thighs coarsely granulate; limbs except for thighs smooth; a distinct fold across breast; a small anal flap.

Forelimb moderately robust and fairly long (33 mm.), 65% of length of head and body; hand 16.5 mm.; finger discs well developed, slightly wider than long, equal in size to tympanum; fingers in order of length, 1,2,4,3; extent of webbing between fingers, 33, 21 and 20%; proximal fringe on 3rd finger, otherwise negligible; subarticular tubercles distinct, transversely rounded, one on 4th finger divided; palm warty; thumb broad at base.

Hindlimb well developed, length (86 mm.) 169% of head and body; femur 25 mm., tibia 25 mm., foot 36 mm.; heel reaches to between eye and nostril; toe discs rather small, roundish, indented below, a little smaller than tympanum (2.5 to 2.75 mm.); toes in order of length, 1,2,3=5,4 on left foot (right is evidently abnormal, 1,2,4=5,3, although the disc on the 4th is apparently normal); extent of webbing between toes, 60, 67, 73 and 74% (here again the right foot is abnormal with the web between the 3rd and 4th toes extending fanwise beyond the disc of the 4th); toes narrowly fringed; subarticular tubercles rounded, distinct but not very prominent; sole small and fairly smooth; inner metatarsal tubercle large and elongated, no outer tubercle.

Vomerine elevations paired, well separated, reasonably rounded but a little elongated transversely, anterior borders of elevations in advance of line joining anterior margins of choanae, but as these are small the elevations also overlap the line joining the posterior margins; tongue subcircular, free and nicked behind, a little less than width of mouth; no external subgular vocal sac.

Dorsal colour dark olive with obscure light markings which become more prominent on the limbs and upper parts of the sides; ventral surfaces yellow.

Specimens examined and Locality Records: 1 (R.12563, A.M.) Dove Lake, Cradle Valley, T. (M. Burrows), 7.i.1941; 2 (1942.38, 1942.271, Q.V.M.) Cradle Valley, T. (M. Burrows).

See also Scott in his description. The three specimens above have been examined.

Variation.—Scott has not confined himself to the type in his original description but pays considerable attention to variation. In the three specimens examined the posterior surfaces of the thighs are all perfectly plain except for a small bluish extension from the dorsum about the vent. The dorsum of R.12563 is mottled dark greenish grey on light yellowish-grey, in 1942.271 it is nearly uniform greenish-grey, and in 1942.38 it is almost uniform bluish with obscure darker mottling. All are yellowish below with a little dark reticulation about the chin. 1942.271 has peculiar, round, yellow lichenoid pustules strongly developed on the dorsal surface of the left tibia and to a lesser extent on the thigh and back. Webbing is fairly constant; that of R.12563, 1942.38 and 1942.271 being respectively for the fingers 33, 21 and 20%; 33, 17 and 18%; 30, 21 and 19%; and for the toes 60, 67, 73 and 74%; 55, 63, 72 and 67%; 60, 71, 72 and 67%. No toes are webbed to the discs except the 2nd on the medial side in 1942.38 and 271. Subarticular tubercles are strongly developed in all, and the inner metatarsal tubercle is elongated and prominent. In these two specimens the vomerine elevations are much as in R.12563 but a little oblique, and the heel just reaches to the anterior corner of the eye.

Discussion.—Scott's new species is the first frog to be described from Tasmania for three-quarters of a century. It has apparently a very restricted range, being known only from Cradle Valley. Sir A. Smith's specimen presented to the British Museum and noted by Günther (1858:113) in his catalogue as *peronii* seems to have been the unique frog to have been collected until Miss M. Burrows secured her series in 1940 and 1941. Scott's very full description is accompanied by a discussion of systematic position, relationship to other Tasmanian forms, and notes on colour in life. *Burrowsi* can at once be separated from *peronii* by the absence of the characteristic black and yellow markings on the posterior surfaces of the thighs of the latter.

HYLA PHYLLOCHROA PHYLLOCHROA Günther.

Synonymy and references: *Calamites cyaneus* (part): Fitzinger (1860: 413). *Hyla phyllochroa*: Günther (1863:251); Krefft (1865:18, 19); Steindachner (1867:61); Keferstein (1868*b*:281); Boulenger (1882:382); Fletcher (1889:359, 367-8, 371, 382-3; 1890:670-1; 1891:263; 1892:12; 1894:527, 530-1); Nieden (1923:232); Loveridge (1935:42).

Günther's original description (1863: 251) reads: *Hyla phyllochroa*, n. sp. (Pl. XXX, figs. C, c).—Snout rather short, broad, with the canthus rostralis angular. The vomerine teeth form two very small groups, situated behind the level of the hinder edge of the inner nostrils. Tympanum distinct, much smaller than the eye. Tongue scarcely notched behind. Perfectly smooth above; belly granular; a fold across the chest. Fingers one-fourth webbed; the membrane between the toes does not extend to the terminal disk. Uniform green above, white below; a very narrow, slightly prominent black line, edged with yellow superiorly, runs from the eye, above the tympanum, to the side of the body, where it is lost. Besides the living specimen in the Society's menagerie, I have examined three others in the British Museum (two from Sydney, received through Messrs. Cuming and Krefft, and one from Errumanga, New). This species possesses the faculty of changing its colours only in a slight degree; it is generally of a uniform light sap-green, which, under certain circumstances, becomes darker. I have not heard a voice from it. Those in the British Museum are females; the largest has the ovaria fully developed, and measures 17 lines from snout to vent; the hind leg 29 lines.

Description of a topotype, No. A.C.6146, an adult female, Warrawee, Sydney, 12.x.1956 (Miss Christina Copland):

Habitus slender with long limbs, length of head and body 38 mm.; head almost semicircular, about as broad as long (13 × 12 mm.); snout rather short (6 mm.), but the curved canthus rostralis makes it prominent, one and a half times diameter of eye (4 mm.), rounded when seen from above, truncated and almost vertical in profile, extending very little beyond lower lip; canthus rostralis curved, distinct and angular; lores only very slightly concave, almost flat and sloping inwards from jaw to canthus rostralis; interorbital width about 1.5 times that of an upper eyelid (4 to 2.75 mm.), top of head nearly flat between prominent eye bulges; internasal space 2.75 mm.; diameter of eye slightly more than its distance from nostril, tympanum distinct, quite smooth and flat, directed very slightly upwards, contained in diameter of eye twice (2 to 4 mm.), distance from eye 1.25 mm.; a low angular supratympanic ridge from eye to above shoulder.

Skin smooth generally, but uniformly and minutely pitted; chin and throat finely granulate; abdomen more coarsely granulate; posterior surfaces of thighs smooth except for proximal sixth of each which together form a strongly granulated squarish patch; otherwise limbs smooth; no chest fold; anal flap very small.

Forelimb slender and long (23 mm.), 61% of length of head and body; hand 11 mm.; finger discs rounded, about same size as tympanum (2 mm.); fingers in order of length, 1,2,4,3; fingers distinctly webbed at base, extent of webbing, 28, 21 and 19%; subarticular tubercles small and rounded; palm partly granulated; thumb not enlarged.

Hindlimb long and slender, length (61 mm.) 161% of head and body; femur 17 mm., tibia 20 mm., foot 24 mm.; heel reaches to between eye and snout; toe discs small, slightly longer than wide, much smaller than tympanum (1.25 to 2 mm.); toes in order of length, 1,2,3=5,4; extent of webbing between toes, 67, 62, 67 and 57%; toes with very narrow fringes; subarticular tubercles rounded, flattened but fairly prominent; sole fairly smooth except for a few small distinct supernumerary tubercles arranged longitudinally; inner metatarsal tubercle elongated and prominent, no outer tubercle.

Vomerine elevations paired, quite small, rounded, narrowly separated, each about the same size as one of the choanae, which are rounded, widely separated from choanae, and placed entirely behind them; tongue slightly elongated, free and hardly indented behind, only occupying about half width of mouth at angle of jaws; no external vocal sac.

Dorsal colour bluish-green; chin and throat brown infusate; belly and limbs ventrally white; a golden or whitish line along canthus rostralis and supratympanic ridge; sides purplish brown flecked with white; front of thighs and practically the whole of posterior surfaces purplish.

Specimens examined and Locality Records: 5 (R.199, A.M.) Kangaroo Valley, Moss Vale dist., N.S.W. (Grant), Jan., 1888; 1 (R.4224, A.M.) Blue Mts., N.S.W. (Thos. Steel), Oct., 1908; 2 (R.4263, A.M.) no data; 1 (R.4340, A.M.) Killara, Sydney, N.S.W. (Dene Fry), Feb. 9, 1909; 5 (R.4344-8, A.M.) Woodford, Blue Mts., N.S.W. (Dene Fry), Feb., 1909; 1 (R.4365, A.M.) Bundanoon, N.S.W. (E. C. Ross), Feb. 9, 1909; 1 (R.4478, A.M.) Seven Hills, Parramatta, N.S.W. (E. C. Ross), May, 1909; 1 (R.4669, A.M.) Woonona, nr. Bulli, N.S.W. (H. L. Coleman), Feb., 1910; 1 (R.5107, A.M.) Sydney, N.S.W. (H. J. Mellor), Jan., 1911; 1 (R.5850, A.M.) Lindfield, Sydney, N.S.W. (D. B. Fry), Aug., 1912; 6 (R.7384-5, A.M.) Burrawang, 20 m. inland from Illawarra, 2000 ft. (J. J. Fletcher), Nov., 1921; 1 (R.7524, A.M.) Moss Vale, N.S.W. (J. J. Fletcher), Feb., 1922; 1 (R.8637, A.M.) Bundanoon, N.S.W. (J. J. Fletcher), Dec., 1924; 2 (R.10563, A.M.) Stanwell Park Creek, N.S.W. (Schevill), 1932; 1 (R.10965, A.M.) no data; 2 (R.11869, A.M.) Heronbrook, N.S.W. (Troughton and Musgrave), 1926; 3 (R.12637-8, A.M.) Lowana, Dorrigo, N.S.W. (Mel. Ward), Jan., 1943; 3 (R.12747, A.M.) Lowana, N.S.W. (Mel. Ward), Dec., 1943; 1 (R.12787, A.M.) Mt. Irvine, N.S.W. (E. L. Troughton), July, 1944; 1 (4263, A.M.) Bundanoon, N.S.W.; 2 (7176, 7178, A.M.) no data; 1 (7179, A.M.) no loc. (G. Krefft); 1 (A.C.3113) Minnamurra Falls, N.S.W., 27.ix.1946; 17 (A.C.4134, 4831-2, 5415-8, 5487-9, 6065, 6068, 6071-2, 6077) Warrawee, N.S.W. (J. and C. Copland), 26.ix.1948-12.x.1956; 4 (A.C.6112-5) Turrumurra, N.S.W., 22.vii.1956; 1 (A.C.6120) Bobbin Head, near Sydney, N.S.W., 31.viii.1956; 2 (A.C.6145-6) Warrawee, N.S.W. (Christina Copland), 12.x.1956; 1 (D.3275, N.M.) Australia; 1 (M.C.Z.3608) Woodford, N.S.W. (Australian Mus), 1914; 1 (M.C.Z.18040) Hornsby Gorge, N.S.W. (P. J. Darlington), 1931; 1 (M.C.Z.18526) Blackheath, N.S.W. (P. J. Darlington), 1932; 1 (M.C.Z.19253) National Park, Q. (F. N. Blanchard), 1928 (last four localities vide Loveridge (1935: 42)); Sydney and Errumanga, both N.S.W., the three cotypes, vide Günther (1863: 251); Dunoon, N.S.W., and between Tomerong and Nowra, N.S.W., vide Fletcher (1891: 263 and 1894: 527).

All specimens listed from the Australian Museum, except R.4344-5, have been examined, making a total of 66 seen.

Variation.—The head is always about as broad as long. In the author's 25 specimens, 18 frogs had the head slightly broader while in seven cases the length and breadth measurements were equal. The snout is only rarely as short as the diameter of the eye. It may be 1.5 times as long, but the average is 1.2. The upper eyelid is usually contained about 1.5 times in the interorbital space, but in a few frogs with very prominent eye bulges the ratio is little more than unity. The diameter of the eye is always greater than its distance from the nostril, sometimes only slightly but normally quite markedly. The tympanum can only be termed distinct in about one-half the frogs. It is covered completely or to some extent by the surrounding granular skin, but can usually be made out in certain lights. In A.C.6112 it is practically indistinguishable. The tympanum is always small and contained twice in the diameter of the eye very consistently, but in two or three cases 2.5 times. The ratio of the length of the forelimb to that of head and body shows little variation with an average of 64% and a range of 60 to 68%. The amount of webbing between the fingers is remarkably constant. That between the 2nd and 3rd fingers varies only 5% between 20 and 25% with an average of 22%. The finger discs are often much larger than the tympanum. They exceed it in 90% of cases and equal it in the rest. The hindlimb averages 169% of the length of head and body with a range of 159 to 177%, except in A.C.6114, where it is 184%. Combined femur and tibia measurements to the length of head and body are remarkably consistent. In 60% of frogs the heel reaches to within 2 mm. of the tip of the snout, and in the remainder to about the same distance in front of it. Toe discs are equal in size to the tympanum in 70% of individuals, larger in 20% and less in 10%. Webbing between the 3rd and 4th toes averages 73% with the range between 67 and 80%. There is a good deal of variation in the vomerine elevations, but all are distinctly behind the choanae, except in one of the R.12747 frogs

where the left half is set abnormally in front of the right one. A very few have a tendency to become oval and transverse. The 23 specimens in the author's collection from Warrawee and Turramurra, which adjoin, give some indication of the variability of this character. Five agree quite well with A.C.6146 of the standard description making six with the rounded elevations each about the size of one of the choanae; 12 frogs have them very or extremely small and widely separated; A.C.5415 has the right one missing and the left extremely small, while A.C.6065 has the left missing and the right small; lastly, the elevations are absent in three specimens. Of 41 specimens examined in the Australian Museum, 21 agreed with A.C.6146 while the other 20 were smaller. R.5107 resembles A.C.6065 in having the left half missing. The dorsal colour is bluish (or bluish-green) or much more rarely brown, except in two specimens, 7178 and A.C.5487, where the whole dorsum is a reddish mulberry. Only two specimens are really brown but about half a dozen others have this colour not so well developed. Preservation tends to convert the brown colour, which is quite common in life, to bluish. It may be noticed that in a mating pair the male A.C.6145 was brown and the female A.C.6146 leaf green. The purple of the thighs and ventral margin of the lower jaw is often modified to a tone of squashed mulberry. The thighs are sometimes without a trace of this colour and are then whitish or yellow. In 25 frogs, 10 had the throat heavily coloured, six were lightly coloured, while nine were immaculate white except for an occasional very narrow margin. The majority of all specimens are immaculate white or yellow below. The Minnamurra Falls specimen and a few others have the underside of the thighs bright yellow. There is no wide, white line along the upper jaw or a continuation to the shoulder. At most there is a thread-like margin to the jaw not extending back past the mouth. The thin white line, generally gold in life, from the nostril and continued behind the eye along the supratympanic ridge is often very distinct even when very narrow. It is not very conspicuous in a few specimens but always present. The line may not extend quite to the nostril. The narrow stripe under the white one is often jet black and most prominent. The largest frog seen was 40 mm. from snout to vent, while several measured between 36 and 38 mm. Günther's type was about 36 mm. and Loveridge's Woodford specimen 41 mm.

Discussion.—Günther's type description (1863: 251) is very clear and diagnostic. He preceded it with a fairly detailed account of the behaviour and feeding habits of *Phyllochroa*, which he observed with other Australian frogs in the Regent's Park Gardens as well as in his own home. Krefft (1865: 19) noted that the species frequented fern groves. Steindachner (1867: 61) gives a good description of four frogs, including two typical specimens from Sydney. Nieden (1923: 232) follows Boulenger (1882: 382) closely. Both say that the snout is as long as the diameter of the orbit, but it is rarely so short if measured from the tip of the snout to the anterior corner of the eye. I think Boulenger followed a different method at least occasionally. Fletcher (see synonymy) has more than a dozen references to distribution and breeding and other habits. *Phyllochroa* has a range of about 700 miles along the narrow coastal strip from Tomerong, a little more than 100 miles south of Sydney, to the Macpherson Ranges about 600 miles north. Fletcher records specimens collected by Helms at Dunoon (1891: 263) and Loveridge lists an M.C.Z. specimen collected by Blanchard in the National Park, Queensland, just over the border from New South Wales. It occurs at Bundanoon and other places on the tablelands and is often seen in the Blue Mountains, but does not appear to extend west beyond the moist, shady gullies of the highlands. *Phyllochroa* is very common at Warrawee and other suburbs on the north side of Sydney Harbour. Its pleasant, rather insect-like skirring call, generally repeated twice, can often be heard at the approach of a shower and on damp evenings.

HYLA PHYLLOCHROA BARRINGTONENSIS, subsp. nov.

Specimens examined and Locality Record: 2 (R.9502, A.M.) Cutler's Pass, Williams River, N.S.W. (A. Musgrave and T. Campbell), 23-30.x.1926.

Discussion.—This subspecies is sharply separated from the typical one by the punctate dorsum. Both specimens examined were juveniles. They are very granular below, and dorsally are only bluish about the head. The rest of the dorsum is brown

with about 20 jet black dots the size of pin's heads scattered all over the back, but concentrated a little on the head, in the larger specimen, R.9502A, which is the type. There are four dots on the smaller individual R.9502B, the paratype. In the type the vomerine elevations are rounded, well separated and about half in advance of a line joining the posterior borders of the choanae. The elevations are missing in the paratype, which accounts for their identification as "*Hylella bicolor*" written on a tag in the tube with them. The eye bulges are very distinct and the snout projecting in both specimens, also the canthus rostralis is rather deeply curved inwards. The frogs are immaculate yellow below. The type measured 20 mm. from snout to vent, the paratype 17 mm. *p. barringtonensis* is very close to the typical *p. phyllochroa* in all other characters, including the gold line from the nostril along the canthus rostralis and supratympanic ridge. The field note reads "found close together on bark of tree".

HYLA RUBELLA Gray.

Synonymy and references: *Hyla rubella*: Gray (1842: 57); Günther (1858: 111; 1867: 56); Keferstein (1868a: 357; 1868b: 283); Boulenger (1882: 405); Fletcher (1890: 667, 673, 675; 1891: 272; 1892: 12, 13; 1894: 530; 1898: 669, 672, 681-3); Spencer (1896: 170); Lucas and Le Souef (1909: 291); Andersson (1913: 22; 1916: 15); Fry (1914: 209); Kampen (1923: 27-8, 62); Nieden (1923: 225); Buxton (1923); Loveridge (1935: 42; 1949: 214); Glauert (1945: 379); Whitley (1947: 53); Main (1954: 118); Mitchell (1955: 404). *Hyla nigrogularis*: Krefft (in lit.), vide Keferstein (1868a: 358).

Gray's original description (1842: 57) reads: *Hyla rubella*. Reddish grey, in spirits; a broad band from the nostrils on the side of the face and along each side of the body purplish: chin, underside of body and limbs whitish, granular: skin smooth: eyes large: the front toes nearly free, the hinder ones more than half webbed; toe-disks moderate: tympanum distinct, sunk: the palatine teeth in 2 small groups, between the inner nostrils. Var. back whitish grey, reddish dotted. Inhabits the North coast of Australia; Port Essington.

Description of R.12810A in the Australian Museum, an adult female, "Welby", Nyngan, N.S.W. (M. Mankin), Oct., 1944:

Habitus small and stocky, total length of head and body 36 mm.; head subtriangular, about as long as wide (10 × 11 mm.); snout short (5 mm.), 1.7 times diameter of eye (3 mm.), rounded both in profile and when seen from above, extending noticeably forward with nostril in front of lower lip; canthus rostralis straight, short, moderately angular; lores flat, receding obliquely; interorbital width about 1.4 times that of an upper eyelid (3.75 to 2.75 mm.), top of head flat between prominent eye bulges; internasal space 2 mm.; diameter of the eye equals its distance from nostril; tympanum very distinct and slightly sunken, directed slightly upward, contained in diameter of eye 1.5 times (2 to 3 mm.), distance from eye 1 mm.; a low and short supratympanic fold encroaching somewhat on the upper margin of tympanum.

Skin above roughened by many closely-set, low, small warts; whole of ventral surface of body and thighs except for narrow margin of lower jaw rather coarsely granulate; limbs smooth except for slight wartiness of forelimb and extension of granular area quite widely up to vent; prominent narrow pectoral fold; small anal flap.

Forelimb moderately robust and short (19 mm.), 53% of total length of head and body; hand 9 mm.; finger discs well developed, wider than long, same size as tympanum (2 mm.); fingers in order of length, 1, 4, 2, 3, 4th and 2nd nearly equal; webbing between fingers confined to junction of the narrow fringes, except for rudiment between 3rd and 4th; one prominent subarticular tubercle on each of four fingers; palm granular, three coalesced tubercles form a large triangular patch on the postaxial side; thumb with a large pad along which a large, elongated, strongly projecting tubercle is set on the preaxial side.

Hindlimb strong and rather short, length (49.5 mm.) 138% of head and body; femur 15.5 mm., tibia 14 mm., foot 20 mm.; heel reaches to front of shoulder; toe discs well developed, wider than long, equal to those of fingers and to tympanum (2 mm.); toes in order of length, 1, 2, 3 = 5, 4; extent of webbing between toes, 40, 54, 61 and 70%; all toes very decidedly fringed to discs; subarticular tubercles rounded and prominent;

sole furrowed and granular; a preaxial tarsal fold; inner metatarsal tubercle elongated and distinct, but only about half size of one on thumb; outer tubercle rounded, small but distinct, in line with 4th toe.

Vomerine elevations paired, small, rounded, distinctly separated; behind, but just touching line joining the posterior margins of the very small, round choanae; tongue heart-shaped with a deep groove at the posterior free end, large and nearly as wide as the mouth at angle of jaws.

A light reddish-brown band as wide as the space between the eyelids extends the whole length of the body; a wide, much lighter, creamy-brown band, tapering off at each end, occupies the remainder of the dorsum on both sides; a blackish-brown dorsolateral band, which dies out before the groin, begins on the head, where it occupies the whole width between the mouth and the nostril; ground colour of the limbs is much the same as the dorsal band; the head, body and limbs are speckled with blackish, and there are three or four large, irregular dark patches bounding each side of the dorsal reddish band; behind the thighs there is a wide area near the vent medium brown speckled with white granules; distally the ground colour of the thighs is pale creamy yellow with much medium brown occurring as stippled patches; the ventral colour is light yellow.

Specimens examined and Locality Records: 4 (R.882-5, W.M.) Mileura Stn., W.A.; 31 (R.1653, R.1692, R.2652-2662, R.2664-2681, W.M.) Lander Stn., Upper Gascoyne, W.A.; 1 (R. 2696, W.M.) Mt. James Stn., W.A.; 1 (R.4042, W.M.) Well 5, Canning Stock Route, W.A.; 1 (R.5010, W.M.) Millstream Stn., W.A.; 1 (R.6213, W.M.) no data; 2 (R.7515-6, W.M.) Belele Stn., W.A.; 27 (R.8320-45, W.M.) Windich Spring, Canning Stock Route, W.A.; 2 (R.8444-5, W.M.) Wandagee Stn., W.A.; 12 (R.9201-12, W.M.) Watjulum Mission, W.A.; 6 (R.10325-30, W.M.) Fitzroy River, W.A.; 8 (R.10568-74, R.10614, W.M.) Minilya Stn., W.A.; 1 (10494, W.M.) Napier, Broome Bay, W.A.; 2 (D.3259-60, N.M.) Charlotte Waters, C.A.; 2 (D.8743, D.8764, N.M.) St. George, Q.; 2 (J.469-70, Q.M.) Bundaberg, Q.; 1 (J.652, Q.M.) Brisbane, Q.; 2 (J.2194, J.2196, Q.M.) Eidsvold, Q.; 2 (J.2554, J.2556, Q.M.) Gylanda, Q.; 2 (R.2715, S.M.) Banka Banka, N.T. (R. V. Southcott), 30.iv.1942; 12 (R.3429, S.M.) Aroona Waters, S.A. (P. F. Lawson), 2.v.1953; 3 (R.3595, S.M.) Botanic Gardens, Darwin, N.T. (G. F. Gross), 27.x.1953; 2 (R.3755, S.M.) Mouth of Italoewie Gorge, Flinders Ranges, S.A. (P. J. Mitchell), 29.x.1955; 2 (R.3791, S.M.) Avenue Range, S.A. (D. J. Barrett), 2.iii.1956; 4 (R.2123-6, A.M.) Central Australia (W. Horn), Dec., 1896; 2 (R.4299-4300, A.M.) Darling River floods, N.S.W. (Helms), May-June, 1890; 3 (R.5032-4, A.M.) Gladstone, Port Curtis, Q. (D. B. Fry), Oct., 1910; 4 (R.5264-5, A.M.) Port Denison, Q.; 2 (R.5340-1, A.M.) Eidsvold, Q. (T. J. Bancroft), 1911-3; 1 (R.5865, A.M.) Brisbane, Q. (McCulloch and Troughton), Sept., 1912; 1 (R.6525, A.M.) Sylvania, Q. (F. L. Berney), Sept., 1915; 2 (R.6781-2, A.M.) Flinders River, Q. (F. L. Berney), Sept., 1915; 1 (R.6985, A.M.) Kimberley Dist., W.A. (H. Basedow), Apr., 1917; 1 (R.7406, A.M.) Bearbong, Murchison, N.S.W. (J. J. Fletcher), Nov., 1921; 4 (R.7570-1, A.M.) Dandaloo, N.S.W. (J. J. Fletcher), Feb., 1922; 1 (R.9409, A.M.) Ashford Downs, N.S.W. (B. Morrisby), Dec., 1927; 1 (R.9551, A.M.) Topar Stn., near Broken Hill, N.S.W. (J. R. Kinghorn), 1928; 6 (R.10309, R.10312, A.M.) 17 m. E. of Dajarra, Q. (T. Hodge Smith), Dec., 1930; 1 (R.10971, A.M.) Whin Creek, Roeburne, W.A. (M.C.Z.), 1933; 14 (R.11353, R.11355-7, A.M.) Alexandra Stn., N.T. (Troughton and Fletcher), 1934; 1 (R.11603, A.M.) Pilliga, N.S.W. (S. Benney), 2.vii.1935; 1 (R.11783, A.M.) The Plains, Nyngan, N.S.W. (D. Wass), Mar., 1936; 8 (R.12808-10, R.12816, A.M.) Welby, Nyngan, N.S.W. (M. Mankin), Oct., 1944; 1 (R.12922, A.M.) Quamby, Q. (H. Williams), Sept., 1945; 1 (R.13636, A.M.) East Alligator River, N.T. (J. E. Bray); 1 (R.14685, A.M.) Mootwingie Waterholes, N.S.W. (R. MacKay), Nov., 1955; 3 (7393, 7395, 7399, A.M.) no data; 3 (A.C.602-4) 1 m. S. of Hivesville, Q., 11.xi.1939; 9 (A.C.3458, 3460-4, 3470, 3472, 3476) Bogan R., near Terowie, N.S.W., 6.iv.1947; 1 (A.C.3609) Wetheron, Q. (C. P. Copland), 1.vii.1947; 1 (A.C.3986) McIntyre Brook, near Whetstone, Q., 11.i.1948; 7 (A.C.4902-8) 3 m. E. of Eulo, Q., 6.i.1953; 5 (A.C.5138-42) Jandowae, Q., 30.xii.1954; 1 (A.C.5151) Reids Creek, near Gayndah, Q., 1.i.1955; 1 (A.C.5171) 5 m. E. of Mundubbera, Q., 3.i.1955; 1 (A.C.5181) O Bil Bil Creek, near Mundubbera, Q., 3.i.1955; 3 (A.C.5257-9) 1 m. N. of Baralaba, Q.,

7.i.1955; 2 (A.C.5284-5) Coomooboolaroo Stn., near Duaringa, Q., 9.i.1955; 1 (A.C.5306) Calliope, Q. (Janet and Christina Copland), 12.i.1955; 1 (A.C.5333) 9 m. S. of Gympie, Q., 15.i.1955; 3 (A.C.5347-9) Takilberan Creek, 23 m. N. of Gin Gin, Q., 14.i.1955; 16 (A.C.5385-5400) 8 m. S.E. of Calliope, Q., 12.i.1955; 2 (M.C.Z.3596-7) Eidsvold, Burnett R., Q. (Australian Mus.), 1914; 4 (M.C.Z. 18041-4) Whin Creek, Roeburne, W.A. (G. E. Nicholls), 1931; 2 (M.C.Z. 18045-6) Gascoyne, W.A. (G. E. Nicholls), 1931; 1 (M.C.Z.18047) Meekatharra, W.A. (Harvard Exped.), 1931; 3 (M.C.Z.184048-50) Yandil, W.A. (P. J. Darlington), 1931; 2 (M.C.Z.18051-2) Lake Barrine, Q. (P. J. Darlington), 1932; 1 (M.C.Z.18053) near Geraldton, W.A. (P. J. Darlington), 1931, M.C.Z. entries vide Loveridge (1935: 42); 1 (M.C.Z.23998) Knuckey's Lagoon, near Darwin, N.T., vide Loveridge (1949: 214); 1 (U.S.N.M.128281) Umba Kumba, Groote Eylandt, N.T., vide Mitchell (1955: 404); Port Essington, N.T., type locality, vide Gray (1842: 57); Houtman's Abrolhos, W.A., Port Denison, Q., vide Günther (1867: 56); Adminga Creek, Alice Springs, Illamurta, between Oodnadatta and Charlotte Waters, and other Central Australian localities, vide Spencer (1896: 170); St. George Range, Kimberley Division, W.A., vide Andersson (1913:22); Napier, Broome Bay, W.A., vide Fry (1914: 209); Mount Tambourine, Q., Malanda, Q., vide Andersson (1916: 15); Pastoral areas of the Murchison, the Gascoyne, and the Goldfields, Mileura Stn. (near Cue), Mount James Stn. (N. of Gascoyne), Canning Stock Route between Wiluna and Hall's Creek, all in W.A., vide Glauert (1945: 379); from about the Murchison River inland and northward to include the whole of northern Western Australia, vide Main (1954: 118).

All 248 specimens from the Australian museums have been examined.

Variation.—There is rarely much difference between the length and width of the head; it is wider in about 10% of cases. The size of the tympanum to that of the eye may be classified as half 15% of specimens, two-thirds 70%, three-quarters 10% and equal 5%. The free edge of the tongue may be markedly indented or almost entire. The dorsum may fairly be described as smooth 25% of cases, slightly warty 28%, rough 31%, and shagreened or very warty 16%. Finger discs are normally equal in size to the tympanum or slightly smaller, an odd specimen may have them as small as a half, they are only larger in about 10% of cases. Webbing of the fingers is generally quite distinct and more than a rudiment, but sometimes it is practically absent. That of the toes varies between half and two-thirds. R.12816 is a tadpole 62 mm. long with the hindlimbs very strongly webbed. Vomerine elevations in eastern and central Australian specimens are well behind the choanae in 28%; behind, but only just, in 67%; while in 5% they are about a third in front of a line joining the posterior borders of the choanae. These unusual specimens come from places as scattered as Central Australia (Horn Expedition), Brisbane and Nyngan. All 99 W.A. specimens have the vomerine elevations totally behind the choanae except for two or three where they encroach a trifle. The W.A. frogs are nearly all brown with black dots and specks; in practically all the blackish line from the nostril through the eye is fairly conspicuous; most are moderately warty, only an exceptional one smooth. All 55 specimens in the author's collection had the vomerine elevations totally behind the choanae, but in eight cases only just. Some specimens had a very wide pectoral fold. Throats were often very black but others were immaculate white. Males had very large external vocal sacs. Nearly all 55 were brown dorsally spotted with black; one Jandowae and two Calliope frogs were very heavily spotted or speckled with black. One Jandowae frog had the finger discs much larger than the tympanum. Three specimens collected together at Nyngan are instructive in dealing with the variable colour of this species. The coloration of R.12810A used in the standard description is widely distributed in eastern Australian frogs. R.12810B is much as A but the wide dorsal band is hardly distinguishable although the black patches persist on each side of it. R.12810C has not the slightest trace of the dorsal band, which is distinct in A and indistinct in B; the black markings have been reduced to small speckles except for more or less continuous longitudinal lines over the ilia; the chin and throat instead of being light are blackish. The majority of all specimens are almost plain dorsally without prominent black lines over the ilia, but with scattered black flecks, spots or tiny dots over the whole dorsum. A trace of the dorsal band may persist

as in B. Others may be almost plain brown or clay coloured without any black. A Djarra specimen is bright red. Many specimens have the chin and throat black. Three Horn Expedition frogs, two from Port Denison and two from Nyngan, are grey with fairly large dark spots. Twelve individuals from Aroona Waters are very warty and are heavily marmorated with black on a grey ground. South Australian specimens normally have considerable black spotting, but in general there does not appear to be geographical control of this character. An odd frog is very dark ventrally. An individual from Mootwingie Waterholes is unusual. It is very warty with a very dark brown dorsum broken by scattered black markings. Ventrally it is sooty with white granules. W.A. specimens are generally nearly plain dorsally except for two dark lines along the posterior half of the body about over the ilia. These lines may be entire, or in various discontinuous combinations, or the patches may be composed of many fine dots. In a few instances the wide dorsal band, which is normally dark, is lighter than its borders, as in A.C.5388. Large individuals rarely reach 38 mm. in total length of head and body.

Discussion.—Günther (1858: 111) dealing with three females in the British Museum says: "Vomerine teeth behind the hinder edge of the nostrils; fingers quite free; toes two-thirds webbed; tympanum one-third the width of eye; tongue large, not notched behind; upper parts quite smooth. Above greyish, sides of head and body with a broad purplish-brown band." The position of the vomerine elevations is diagnostic although not always valid, and it is interesting that Gray in his original description (1842: 57) says "the palatine teeth in two small groups between the inner nostrils". The original "front toes nearly free" is also more accurate than "fingers quite free". Kesterstein (1868a: 358) notes that Krefft had remarked on the black throat of many specimens. Fletcher (see synonymy) has about a dozen references to *rubella* mainly dealing with distribution. He considers it restricted to the inland. Boulenger (1882: 405) and Nieden (1923: 225) give good descriptions. Boulenger remarks: "Fingers and toes very variable in shape; in some specimens they are moderate, with rather small disks, in others short and stout with very large dilations; but as some specimens exhibit an intermediate structure, it is impossible to attach a specific importance to this character, though when the two extreme forms are placed side by side, the difference is a very striking one." His largest specimen measured 39 mm. Spencer (1896: 170), who had many specimens collected by the Horn Expedition, dealt quite fully with the external form of both the adult and tadpole as well as distribution and habits. He pays particular attention to variation, noting *int. al.* that "in most specimens the head is scarcely as long as broad"; arrangement of vomerine teeth; variation of tympanum from half to two-thirds diameter of eye and its distinctness; size of discs; and coloration. Most of the points raised have been discussed above. Spencer also deals with the question of survival in drought and methods of repopulation in areas where frogs have been wiped out. Andersson (1913: 22) with 13 specimens from the Kimberleys questions descriptions of the toes as $\frac{2}{3}$ to $\frac{3}{4}$ webbed and concluded that the degree was only about half, and in some small specimens "not even half webbed". Later (1916: 15) he reports a Queensland frog as "beautifully purple on all parts visible from above". Loveridge (1935: 42) gives diagnostic notes and remarks "in formalin preserved specimens it will be seen that the fifth toe is actually webbed to the base of the disk, a condition which is apt to be masked in alcohol-preserved frogs". He (1949: 214) notes that a Northern Territory individual had the head longer than broad and the vomerine elevations between the posterior borders of the choanae. Glauert (1945: 379) has interesting notes on the habits and environment of this little frog. Whitley (1947: 53) remarks "the wide range of this fish Spangled Perch, *Madigania unicolor* . . . almost coincides with that of the frog *Hyla rubella*". Main (1954: 118) gives short notes on range, habitat and description. This typically inland species reaches the north-west, north, and north-east coasts of the continent. It is fairly homogeneous but there seems to be a tendency for eastern specimens to have the vomerine elevations more forward than the western, and the species may yet be separated on this fact as well as colour. I suspect that records from the North Coast of New South Wales are based on *dentata* with which it may quite easily be confused.

HYLA DENTATA Keferstein.

Synonymy: *Hyla dentata*: Keferstein (1868a: 329; 1868b: 284); Boulenger (1882: 406); Fletcher (1889: 360, 383; 1890: 669-671, 675; 1891: 274; 1892: 8, 12, 14; 1894: 525, 527, 530; 1898: 672); Nieden (1923: 233); Loveridge (1935: 42).

Keferstein's original description (1868a: 329) reads: *Hyla dentata*, sp. n. Kopf kurz, abgestutzt; Seiten hoch, Canthus rostralis abgeflacht. Trommelfell mindestens halb so gross, als die sehr hervorragenden Augen. Habitus ähnlich wie bei *H. Peronii*. Vomerzähne hinter den Choanen, in zwei halbkreisförmigen oder hufeisenförmigen, nach vorn offenen Gruppen, welche mindestens so grossen Durchmesser als die Choanen haben.—An der Hand sehr kleine Schwimmhäute, am Fusse sehr grosse, die nicht einmal ganz die letzten Phalangen frei lassen und als Säume sich bis zu den Zehenspitzen fortsetzen. Haftscheiben gross. Hand- und Fusssohlen mit feinen Warzen. Am Metatarsus ein stumpfer Höcker, am Tarsus eine Hautfalte.—Rückenseite theilweis mit kleinen rundlichen Höckern, hellbraun, mit feinen dunklen Punkten. Vom Canthus rostralis aus zieht an den Seiten bis zur Mitte der Körperlänge ein dunkler Streif. Unterseite einfarbig hell, über der Brust eine quere Hautfalte.—Körper 29 mm., Bein 45 mm. lang.

Neu-Süd Wales (ein Exemplar, von Dr. Schuette).

Schon durch die eigenthümlich gestellten Vomerzähne unterscheidet sich diese Art von allen sonst bekannten, da mir jedoch nur ein Exemplar zu Gebote steht, muss ich es unentschieden lassen, in wie weit die ringförmige Stellung derselben ein constantes Merkmal ist.

Description of R.13073, in the Australian Museum, an adult male, Brush Creek, Wyong, N.S.W. (R. MacKay):

A compact, sturdy little frog, total length of head and body 40 mm.; head sub-triangular, about as broad as long (12 mm.); snout short (5.5 mm.), 1.2 times diameter of eye (4.5 mm.), truncate when viewed from above, in profile slightly protuberant and receding towards mouth, nostril above lower lip; canthus rostralis short, rounded but fairly distinct; lores oblique, nearly flat, interorbital width greater than that of an upper eyelid (4 to 3.5 mm.), top of head flat between prominent eye bulges; internasal space 3 mm.; diameter of the eye very slightly more than its distance from nostril; tympanum round, very distinct although encroached upon slightly dorsally by the low supratympanic ridge, tilted slightly upward, contained in diameter of eye 1.6 times (2.75 to 4.5 mm.), quite close to eye.

Skin smooth above except for a few, small, scattered, low warts; chin and throat fairly smooth; body and ventral surfaces of thighs rather coarsely granulate; otherwise limbs smooth below; nearly half of posterior surfaces of thighs granular in a wide, triangular patch extending up to vent; a small, granular anal flap.

Forelimb robust and fairly long (25 mm.), 62% of length of head and body; hand 11 mm.; finger discs well developed, roundish but a little wider than long, slightly larger than tympanum (3 to 2.75 mm.); fingers in order of length, 1, 2, 4, 3; extent of webbing between fingers, 40, 43 and 40%; fingers practically free of fringing; sub-articular tubercles low and rounded, not very distinct; palm divided; thumb with basal pad and black nuptial shield, practically opposed.

Hindlimb moderately strong and long, length (58 mm.) 145% of head and body; femur 16 mm., tibia 17 mm., foot 25 mm.; heel reaches to eye; toe dists much smaller than those of fingers (2 mm.); toes in order of length, 1, 2, 5, 3, 4; extent of webbing between toes, 46, 62, 70 and 73%; narrow fringes; subarticular tubercles distinct although small and rounded; sole divided; a comparatively large, elongated inner metatarsal tubercle, no outer one.

Vomerine elevations paired, well separated from each other and even more widely from the considerably smaller choanae, oblique, convergent posteriorly, just behind a line joining the centres of the choanae, by far the greater part totally behind; tongue heart shaped, free and quite deeply indented behind, much narrower than mouth at angle of jaws; the large external vocal sac is rucked up without regular pleats although the posterior margin is somewhat transverse and replaces a pectoral fold; the sac opens into the mouth by a large elongated slit at each side of the tongue.

The most characteristic dorsal marking is a wide dark brown median band the whole length of head and body. It covers slightly more than half the back and is composed of three more or less equally sized rounded areas marked off by two waists. The remainder of the dorsum is occupied by a light brown irregular stripe on each side of the median band. A dark brown stripe runs from the eye, includes the tympanum, and passes to the groin, where it is joined by a downward prolongation of the mid-dorsal band. The dorsal surfaces of the limbs are rather light brown sparingly mottled with darker. The sides are sprinkled with white spots. An indistinct white line along the upper jaw dies out at the shoulder. The back of the thighs is pale brown sprinkled with small white dots, but there is a darker area with larger spots on each thigh; these two areas are narrowly separated by a vertical light line from the vent; ventral surfaces are light yellow, except the vocal sac, which is nearly black.

Specimens examined and Locality Records: 1 (R.778, A.M.) Campbelltown, N.S.W. (A. M. N. Rose), Dec., 1889; 1 (R. 3952, A.M.) Parramatta, N.S.W. (A. R. McCulloch); 4 (R.4655-7, R.4659, A.M.) Woonona, nr. Bulli, N.S.W. (H. L. Coleman), Feb., 1910; 3 (R.4907, A.M.) Tuggerah Lakes, N.S.W. (D. B. Fry), 14.vii.1910; 1 (R.5102, A.M.) Parramatta, N.S.W. (A. R. McCulloch); 1 (R.5252, A.M.) Smithfield, nr Sydney, N.S.W. (J. Stein); 1 (R.5896, A.M.) Nambucca River, N.S.W. (H. E. Smart), Sept., 1912; 2 (R.6326-7, A.M.) Gurravembi, Nambucca River, N.S.W. (D. B. Fry and H. E. Smart), Oct., 1913; 1 (R.8294, A.M.) Somersby, via Gosford, N.S.W. (D'Ombraïn), Mar., 1924; 1 (R.8457, A.M.) Fitzroy Falls, N.S.W. (T. Steele), Nov., 1924; 1 (R.8701, A.M.) no data; 2 (R.9280, A.M.) Raymond Terrace, N.S.W. (D'Ombraïn), Apr., 1927; 2 (R.10507-8, A.M.) Wyong, N.S.W. (J. H. Wright), Nov., 1931; 1 (R.11069, A.M.) Wyong, N.S.W. (J. H. Wright); 2 (R.12293, A.M.) Evans Head, N.S.W. (Mel Ward), 1938; 1 (R.13073, A.M.) Brush Creek, Wyong, N.S.W. (R. Mackay), 1 (A.2843, A.M.) Pallamallawa, N.S.W. (D. A. Porter), June, 1900; 1 (A.2880, A.M.) loc.? (D. A. Porter), June, 1900; 2 (7277, 7290, A.M.) no data; 2 (M.C.Z.876, 1934) Sydney, N.S.W. (Göttingen Museum), 1885; 1 (M.C.Z.3609) near Bulli, N.S.W. (Australian Mus.), 1914, last two entries vide Loveridge (1935: 42); 3 (A.C.3662-3, A.C.3665) Hickey's Creek, near Bellbrook, N.S.W., 25.xii.1947; 3 (A.C.3681-3) near Bellbrook, N.S.W., 27.xii.1947; 3 (A.C.3947, A.C.3949-50) Tooloom Falls, near Urbenville, N.S.W., 9.i.1948.

Excluding the three M.C.Z. frogs, all 38 specimens listed above have been examined.

Dunoon, lower Clarence River, the Blue Mountains and Jervis Bay should be noted here as additional records from Fletcher (see synonymy).

Variation.—Disregarding obvious juveniles the average adult length of head and body is very stable, averaging 40 mm. (42 mm. twice). In 28 adult specimens the head was wider than long in 17 cases, equal in seven, and longer than wide in four. The snout is always distinctly truncate, especially when viewed a little postero-dorsally. Its length varies between 1.2 and 1.5 times that of the eye, and averages 1.33. Average width of the upper eyelid to that of the interorbital space is four-fifths. The tympanum, which is always distinct, is contained in the diameter of the eye on the average 1.8 times. Two of the Tooloom Falls frogs are quite smooth dorsally; R.5102 and R.8701 are noticeably more warty dorsally than usual; all the others are sparingly sprinkled with small, low warts. The triangular granular area behind the thighs is invariably present. The length of the forelimb averages 56% of that of head and body and with the percentage of webbing on the fingers is very constant. In 28 specimens the largest finger disc was equal in size to the tympanum in eight cases, smaller in only one, and larger, often quite markedly, in 19. It is probably always considerably larger in fresh material. The length of hindlimb to that of head and body is fairly constant, the ratio averaging 150%. Webbing on the toes is very constant. The toes are never webbed anywhere near the discs, which are always smaller than those of the fingers. There is much variation in the vomerine elevations without any real explanation. In the 38 specimens checked, 12 agree with R.13073 of the standard description; 13 have the same position but are small and rounded; two are extremely small; six are convergent and much the same size as R.13073 but totally behind the choanae; and the remaining four are small and rounded and totally behind the choanae. Seen with

the eye of faith a few of the larger vomerine elevations show an ill-defined arcuate pattern of small teeth. The trilobed median band is characteristic and generally very distinct except in a few bleached specimens. The two dark, warty, white spotted areas below and on each side of the vent are constant, except in juveniles, where the white spots are present but the dark brown ground colour has not yet appeared. In spite of this late development in coloration behind the thighs the dorsal and lateral patterns of even quite small juveniles are generally more pronounced than in adults.

Discussion.—This is a rather distinct species if we except *rubella*, with which it may easily be confused, especially when the vomerine elevations are small, rounded, and set well back. Keferstein (1868b: fig. 21) gives a neat, symmetrical drawing of "Vomerzähne hinter den Choanen in zwei halbkreis- oder hufeisenförmigen, nach vorn offenen Gruppen" for his single type specimen sent from Sydney by Dr. Schuette. He is followed by Boulenger (1882: 406) with "vomerine teeth subcircular, behind the level of the choanae, the teeth on each of them arranged in an arch the concavity of which is turned forwards" for his eight frogs from Sydney. This character which gives the frog its name does not normally appear to be plain enough to be conveniently diagnostic. It is dealt with more fully above under variation. Boulenger also uses as a key character "tibiotarsal articulation not reaching the eye", and in his description "reaches the tympanum or not quite so far". Combined tibia and femur measurements of specimens in the Australian Museum average only 4 mm. less than that of head and body, and in one case at least the heel reaches the snout. Loveridge (1935: 43), who had three specimens from Sydney and Bulli, noted that in all the heel marked the tympanum or the eye. Boulenger's largest specimen was 48 mm. from snout to vent. Nieden (1923: 233) gives a practically literal translation of Boulenger's full description. Fletcher (see synonymy) notes *dentata* about 15 times and discusses distribution, ecology and classification. He first believed it to be a rare frog, of which he had only two specimens, but later (1894: 527) found half-grown specimens "surprisingly numerous" at Jervis Bay. The frog probably only appears to be rare because of its secretive habits. Three frogs were found by the author 10 feet above the ground under the bark of a small, dead tree, and six others under logs and timber lying in grass. They were dorsally brown or dark grey bordered laterally with cream, and ventrally white or pinkish. Fletcher suggests possible confusion with *verreauxii* (1892: 14). The species appears to be practically confined to the narrow coastal strip of New South Wales east of the Dividing Range from about the Queensland border in the north to Jervis Bay in the south. A specimen from Fitzroy Falls shows that its range extends to the tablelands, while the record from Pallamallawa, 200 miles from the coast, suggests that colonies at least exist on the western slopes and plains, where they have probably been carried from the highlands along rivers flooding into the Darling system. The species will almost certainly be found in southern Queensland and somewhat south of Jervis Bay.

HYLA CITROPA (Tschudi).

Synonymy: *Dendrohyas citropa*: Tschudi, Péron MS. in (1838:75). *Hyla citropa*: Duméril and Bibron (1841:600). *Hyla (Dryopsophus) citropa*: Fitzinger (1843:30). *Hyla citropus*: Günther (1858: 115); Keferstein (1868b: 281); Boulenger (1882: 408); Fletcher (1889:359, 365, 368, 371, 383; 1890: 671, 675; 1891: 264; 1894: 530-1); Andersson (1916: 15); Nieden (1923: 233); Kinghorn (1932: 362); Loveridge (1935: 43).

Tschudi's original description (1838: 75) gives little more than the first publication of the name and reads: *Dendrohyas citropa* (Nov. Holl.). Syn. *Hyla citropa* Per. (Port Jackson).

Description of R.8459 in the Australian Museum, an adult male, Pennant Hills, near Sydney, N.S.W., collected by T. Steel, Nov., 1924.

Habitus typically Hylid with a broad head and narrow waist; total length of head and body 48 mm.; head nearly triangular, broader than long (19 × 17 mm.); snout short (8 mm.), 1.3 times diameter of eye (6 mm.), truncate when viewed from above, receding in profile, projecting with nostril a shade in advance of lower lip; canthus rostralis nearly straight and sharply angular; lores gently concave, sloping

obliquely; interorbital width about equal to that of an upper eyelid (5 mm.), top of head almost flat between the prominent eye bulges; internasal space 4 mm.; diameter of the large eye noticeably greater than its distance from nostril; tympanum distinct, directed somewhat backward as well as slightly upward, contained in diameter of eye 2.2 times (2.75 to 6 mm.), distance from eye 2 mm.; a distinct, rounded supratympanic fold curving from eye to just in front of shoulder.

Skin above mildly granular anteriorly, markedly so on eyelids; many very small, low, dot-like warts; ventral surfaces of body and thighs granular, except smooth margin of jaw; no granular extension to vent; triangular granular areas before and behind tympanum; a prominent glandular area behind angle of mouth; sides smooth; no pectoral fold; very small anal flap.

Forelimb robust and moderately long (30 mm.), 63% of length of head and body; hand 13 mm.; finger discs thick and rather rounded, but wider than long, smaller than tympanum (2 to 2.75 mm.); fingers in order of length, 1, 2, 4, 3; webbing between the fingers may be said to be absent or rudimentary, being confined to the junction of the fringes; subarticular tubercles rounded, prominent; palm divided with a large tubercle posteriorly; thumb almost at right angles, swollen with two large basal tubercles and a black nuptial shield.

Hindlimb moderately strong and long, length (82.5 mm.) 171% of head and body; femur 23.5 mm., tibia 26 mm., foot 33 mm.; heel reaches to tip of snout; toe discs closely resembling those of fingers but a trifle smaller (1.75 mm.); toes in order of length, 1, 2, 3, 5, 4; extent of webbing between toes, 25, 45, 50 and 46%; fringes narrow; subarticular tubercles low, rounded, not prominent; sole fairly smooth; inner metatarsal tubercle large and oval; outer about a quarter its size, rounded, in a line between 3rd and 4th toes.

Vomerine elevations paired, rather small, elongated, convergent posteriorly, well separated from each other and from the equally sized choanae, just behind line joining posterior margins of choanae or possibly encroaching a trifle; tongue subcircular, slightly free and indented behind, about half width of mouth; vocal sac internal with an opening on each side of tongue.

Dorsal colour almost uniform bluish-grey, with small, black, dot-like warts and inconspicuous small patches of the same colour; dorsal surfaces of limbs, the area being quite narrow on the thighs, and patch above vent more heavily marked with black; a wide black band along canthus rostralis and then along supratympanic fold almost to groin, behind the eye it is narrowly edged dorsally with white and posteriorly broken up by white spots and patches; a white line runs along the upper jaw and becomes very conspicuous between the eye and forelimb, where it dies out; ventral surfaces yellow becoming brighter under the hindlimbs and on the fore and hind surfaces of the thighs.

Specimens examined and Locality Records: 2 (R.4261, R.4263, A.M.) Bundanoon, N.S.W. (W. Thorpe and T. Henson), 1908; 1 (R.4326, A.M.) Lindfield, Sydney, N.S.W. (D. B. Fry); 1 (R.5188, A.M.) Katoomba, N.S.W. (Fry and Coleman), Feb., 1911; 1 (R.7110, A.M.) Hazelbrook, N.S.W. (L. Abrahams), Jan., 1920; 2 (R.7558-9, A.M.) Waterfall, N.S.W. (J. J. Fletcher), Feb., 1922; 3 (R.7560-2, A.M.) Aberfeldy, V. (J. J. Fletcher), Feb., 1922; 1 (R.7563, A.M.) Manly, N.S.W. (J. J. Fletcher), Feb., 1922; 1 (R.8459, A.M.) Pennant Hills, N.S.W. (T. Steel), Nov., 1924; 1 (R.14495, A.M.) Colo Vale, N.S.W. (H. Cogger), 16-20.xii.1954; 1 (7111, A.M.) Ryde, N.S.W. (Kreffit); 3 (7112-4, A.M.) Middle Harbour, Sydney, N.S.W. (G. Krefft); 1 (7117, A.M.) Mulgoa, N.S.W. (J. C. Cox); 2 (D.6709-10, N.M.) Grafton, Clarence River, N.S.W.; 1 (D.7838, N.M.) Tubrabucca, N.S.W.; 1 (D.8843, N.M.) Ryde, Parramatta River, N.S.W.; 4 (372-5, R.D.M.) Waterfall, N.S.W., 6.viii.1950; 1 (658, R.D.M.) Oxford Falls, Brookvale, N.S.W., 13.v.1950; 4 (M.C.Z.9581-4) Hornsby, N.S.W. (W. H. Rosenberg), 1924, vide Loveridge (1935: 43); Port Jackson, N.S.W. (type of *Dendrohyas citropa*) vide Tschudi (1838: 75); Errumanga?, N.S.W., vide Boulenger (1882: 408); Waterfall, Springwood, Mt. Wilson, and other localities in the Blue Mountains, "in the moist shady gullies", vide Fletcher

(see synonymy); Cedar Creek, Q., Apr., 1913, vide Andersson (1916: 15); Stanwell Park, Hampton (4000 ft.), and various localities in the Blue Mountains west of Sydney, vide Kinghorn (1932: 362).

I have examined 16 specimens, comprising those marked N.M. and R.D.M., and R.4326, R.7561-2, R.8459, R.14495 and 7111-2 in the Australian Museum.

Variation.—The webbing between the fingers may be absent as in R.7561-2, confined to the junction of the fringes as in R.8459 and 7111, or considerably developed especially between the 2nd and 3rd fingers as in R.14495 and 7112. A distinct web may fairly be said to be present in half the specimens. Finger discs vary between 70 and 90% of diameter of tympanum (100% once). Males with black nuptial pads have the thumb tubercles most prominent. One of the two large tubercles may be divided again into two prominent cones. The heel reaches the tip of the snout in 10 of the 16 specimens, beyond in four, and not quite to nostril in two. Variation of webbing between toes is very slight. The inner metatarsal tubercle is always prominent, the outer varies between indistinct and very indistinct. There is always a tarsal fold, but it is not at all prominent. There is slight variation in the size and position of the vomerine elevations. In four cases they are somewhat heavier and more transverse than in R.8459, but in six slightly smaller and more oblique. In R.14495 they are exceptionally small, low, rounded and well separated. In 7112 they encroach considerably on a line joining the posterior borders of the choanae, and in two cases they are totally behind, but the remaining 13 frogs are as R.8459. Colour and markings are very constant. Fresh material such as that from Waterfall shows the supratympanic stripe jet black and extremely distinct. A marked feature common to all 16 frogs is the white nearly continuous line under the eye, below tympanum, to become most pronounced, although broken up, over the glandular area behind the mouth. The line begins at the tip of the snout in a squarish black and white marbled area as wide as the space between nostrils. This area is clear except in three or four very faded specimens. The glandular area behind the mouth is always present and marked. It is usually in three or four sections, but one gland may be very large and the remainder very small. Two of the Aberfeldy frogs (only R. 7561-2 seen) are identical with N.S.W. specimens even to small details such as the small speckled or marbled snout and anal areas. The largest specimen examined was 7112 with head and body 62 mm. and hindlimb 97 mm.

Discussion.—This is a compact species with little variation. It is seldom present in collections. Kinghorn (1932: 362) noted that it was somewhat closely related to *rubella* and *dentata*, but was without doubt the rarest of the three. He believed that its range was restricted to an area close to Sydney—Mt. Wilson to the north, the Jamieson and Kanimbla Valleys to the south and the foothills of the Dividing Range to the west. He suggested that Fletcher's specimens from Aberfeldy, about 120 miles east of Melbourne, should be referred to *dentata*, but the two Aberfeldy frogs I have examined in the Australian Museum are certainly *citropus* and if the locality was recorded correctly the species must range far south in Victoria. The species also extends north of Mt. Wilson, about 55 miles in a direct line from Sydney. There is an undoubted specimen from Tubrabucca in the Barrington Tops area, about 150 miles north, and two others from Grafton, 440 miles north of Sydney. I would like to defer acceptance of Andersson's (1916: 15) record from Cedar Creek on the Atherton Tableland, Queensland, especially as his specimen was very young (17 mm. from snout to vent). Andersson said his frog corresponded very well with Boulenger's (1882: 408) description and with Kieferstein's figure (1868: fig. 22). The colour in spirit was greyish-blue without any purplish, and the broad irregular black lateral band was very distinct without any light edge above. This involves an extension of range northwards from Grafton of more than 1000 miles and it would be wise to await confirmation by further and adult specimens before regarding this record as established. This species has practically no literature, but Fletcher on 10 pages (see synonymy) deals with its breeding and other habits and distribution. In spite of its apparent rarity MacKay has told me that it is quite

common in the Stanwell Park area. Kinghorn (1932: 362) gives a detailed account of colour, colour changes and sexual dimorphism in the living frog. Nieden's description (1923: 233) is simply a translation of Boulenger's (1882: 408).

HYLA MACULATA Spencer.

Synonymy and references: *Hyla maculata*: Spencer (1901: 177); Fry (1912: 97); Nieden (1923: 236).

Spencer's original description (1901: 177) reads: *Hyla maculata*, sp. n. Tongue subcircular; free and slightly nicked behind. Vomerine teeth in two small groups close to the middle line behind the level of the choanae. Head decidedly broader than long. Snout as long as broad; truncate and slanting downwards so that the nares are vertically on a level with the margin of the upper jaw. Canthus rostralis distinct; the loreal region oblique and slightly concave; interorbital space nearly twice as broad as the upper eyelid. Tympanum not visible. Fingers very slightly webbed; toes completely webbed. Discs on the fingers slightly larger than those on the toes. Subarticular tubercle present, no outer metatarsal tubercle. A distinct fold extending over the tympanic region to the shoulder. The hind limb being carried forwards, the tibio-tarsal articulation reaches the anterior canthus of the eye. Upper surface of the body covered with minute pits, the closely opposed margins of which present a finely reticulate appearance; lower surface granulate. A distinct fold along the inner edge of the tarsus. Colour, olive grey above, blotched with darker markings; the same on the upper surfaces of the limbs. Length from snout to vent, 50 mm. Habitat, Powong, Victoria. Collected by Mr. R. Hall.

Discussion.—This is a puzzling species, which does not appear to have been seen or discussed since it was first described. Fry only notes that he has not seen it and Nieden repeats the description. In keys based on Boulenger it falls with *phyllochroa*, *rubella*, *dentata*, and *citropus*; and, with the vomerine teeth behind the level of the choanae, it could not be associated elsewhere. It is separated from all of them by the extent of webbing, and with having an olive-grey back blotched with darker markings. Even more important differences are the concealed tympanum and the minute pitting of the dorsum so that the closely opposed margins of the pits present a finely reticulate appearance. It seems remarkable that this distinctive frog has not been collected again during the past 56 years, especially as Powong in Gippsland is only about 60 miles from Melbourne. Spencer's specific reference to discs makes it unlikely that *maculata* belongs to any other genus.

HYLA OBSOLETA NANNOTIS Andersson.

Synonymy: *Hyla obsoleta*: Lönnberg (1900: 580); Kampen (1923: 24, 32); Loveridge (1935: 50). *H. nannotis*: Andersson (1916: 16).

Lönnberg's original description (1900: 580) reads: *Hyla obsoleta*, sp. n. The most striking characteristic of this form is that the tympanum is completely covered by the granular skin, so that no trace of it can be seen outwardly. Tongue broadly rounded anteriorly, nicked and free behind. Vomerine teeth in two small well-separated groups between the choanae. Snout subtriangular, longer than the diameter of eye, truncate at the tip; canthus rostralis distinct; loreal region concave; interorbital space broader than the upper eyelid. Fingers with a short web at the base; toes nearly entirely webbed; disks about half the diameter of the eye. A slight cutaneous fold with a row of tubercles along the outer side of the forearm; a less pronounced row of tubercles along the outer side of the tarsus; a short dermal appendage at the heel. The hind limb being carried forward, the tibio-tarsal articulation reaches beyond the snout. Upper surfaces minutely granulate; a fold from the eye to the axilla; another fold across the throat. Belly and lower side of thighs granulate. Colour (in spirit) dark brown above, light below, without markings. From snout to vent 34 millim. A single specimen from Simbang.

Andersson's original description (1916: 16) reads: *Hyla nannotis*, n. sp. (Figs. 5a-e). Tongue semicircular, slightly nicked behind. Vomerine teeth in two transverse groups on a level with the hind edges of the choanae. Snout short, rounded, slightly

prominent, a little shorter than the orbit; nostril near the end of the snout; canthus rostralis rounded, loreal region oblique and concave. Interorbital space somewhat broader than the upper eyelid. Tympanum very small, about one-fourth the diameter of the orbit, its upper margin not distinct. Fingers rather long and slender, webbed at the base, a distinct rudiment of pollex; toes nearly entirely webbed; disks of fingers larger than disks of toes, which are a little larger than the tympanum. A tarsal fold; no outer metatarsal tubercle, inner very distinct, long and oval. If the length of the tibia is marked off from the knee forwards along the body, it reaches beyond the snout. Skin very finely granulate or prickled above, and provided with small, sparsely scattered tubercles on the head and back. Coarsely granular below and on the sides of the body; a distinct fold above the tympanum. Dark olive grey or brownish above, closely and irregularly speckled with blackish; the lower surfaces of the limbs and of the hind part of the belly reddish brown, remaining lower parts brownish grey, the chin spotted with black. A male specimen from Tully River, N. Queensland, April, 1913. Measurements: Total length 45 mm. Breadth of head 16 mm. Length of head (from the hind margin of tympanum) 15.4 mm. Length of snout 6.2 mm. Diameter of eye 6.8 mm. Diameter of tympanum 1.6 mm. Length of humerus 9.5 mm. From elbow to tip of 3rd finger 22 mm. Length of femur 25.8 mm. Length of tibia 25.8 mm. Length of tarsus and 4th toe 32.5 mm. By the very small tympanum this species seems to be allied to *Hyla arfakiana* Peters and Doria and possibly to *Hyla parvidens* Peters. But according to the descriptions, the former has "snout acuminate, longer than the diameter of the orbit; canthus rostralis straight, loreal region not very oblique, fingers free, no distinct rudiment of pollex; toes two-thirds webbed, skin smooth above etc.". The colour is rather dissimilar as well, and to judge from the figures in *Ann. mus. Civ. Genova*, 13, 1878, pl. 6, fig. 2, the disks of the fingers and toes are considerably smaller in *H. arfakiana* than in my specimen. *Hyla parvidens* has vomerine teeth hardly distinguishable, considerably shorter hind limbs, a quite different colour, etc.

Description of No. R.10980, in the Australian Museum, an adult, Mt. Spurgeon, Q. (Loveridge, Museum of Comparative Zoology, Harvard), 1933:

Habitus rather slender with a wide head and tapering body, width of body (18 mm.) 36% of total length of head and body (50 mm.); head nearly semicircular, flattened, about as broad as long (18.5 × 17.5 mm.); snout moderately long (8 mm.), one and two-thirds diameter of eye (6 mm.), obtusely rounded when seen from above, rounded and slightly pointed in profile, extending well beyond lower lip; canthus rostralis strongly curved, distinct, rounded; lores markedly oblique, concave; interorbital width greater than that of an upper eyelid (5.5 to 4 mm.), top of head flat between prominent eye bulges; internasal space 4 mm.; diameter of eye slightly more than its distance from nostril; tympanum visible but indistinct, little differentiated from surrounding skin, especially upper margin, tilted slightly upward, contained three times in diameter of eye (2 to 6 mm.), distance from eye 2 mm., a low, slightly warty, supratympanic ridge.

Skin above smooth or minutely granular with a few small scattered warts; chin and throat finely granular; ventral surfaces of body and thighs with part of posterior surface up to vent coarsely granular; sides granular below, rather warty above; no pectoral fold; a distinct anal flap.

Forelimb strong and moderately long (33 mm.), 66% of length of head and body; hand 17 mm.; finger discs well developed, rounded but slightly wider than long, larger than tympanum (3 to 2 mm.); fingers in order of length, 1, 2, 4, 3; a strong rudiment of web between fingers, amounting to 17, 20 and 21%; no fringes; subarticular tubercles distinct, rounded; palm granular; thumb at right angles to next finger, strongly broadened at base, which is divided as if prepollex is present; a low fold marked by about six white warts behind forearm.

Hindlimb long, strong, well-developed, length (95 mm.) 190% of head and body; femur 26 mm., tibia 31 mm., foot 38 mm.; heel reaches to well in advance of snout; toe discs well developed, slightly wider than long, a little smaller than finger discs but still larger than tympanum (2.5 to 2 mm.); toes in order of length, 1, 2, 3 = 5, 4;

extent of webbing between toes, 55, 71, 78 and 75%, webs practically to discs of first three fingers on postaxial sides; toes fringed; subarticular tubercles distinct, rounded; sole fairly smooth, a large, elongated, inner metatarsal tubercle, no definite outer one; a low tarsal fold with small white tubercles.

Vomerine elevations paired, distinctly separated, slightly elongated, transverse, each bearing about six very small teeth, large, considerably larger than the round choanae, about bisected by a line joining the posterior borders of the choanae or a little in advance; tongue roundish, free and feebly nicked behind, noticeably narrower than mouth at angle of jaws; no external vocal sac.

Dorsal colour a rich warm brown with obscure blackish marbling; ventrally pale yellow with a brownish suffusion on chin and throat; posterior surfaces of thighs almost uniform brown with a few rather large patches formed of confluent white spots.

Specimens examined and Locality Records: 1 (Type of *H. nannotis*) Tully River, N.Q., Apr., 1913, vide Andersson (1916); 1 (R.10980, A.M.) Mt. Spurgeon, Q. (Loveridge, M.C.Z., Harvard), 1933; 1 (J.5570, Q.M.) Mt. Spurgeon, Q.; 19 (M.C.Z.18114-25) Mt. Spurgeon, Q. (P. J. Darlington), 1932, vide Loveridge (1935).

Variation.—Only one other specimen (J.5570) has been examined. It is also from Mt. Spurgeon and smaller. Its proportions and other characters agree almost exactly with R.10980, but the tympanum is perhaps more distinct and a trifle smaller. Dorsally it is a uniform leaden plum, and the ventral surfaces are greyish to flesh-coloured.

Discussion.—Lönnberg (1900: 574) mentions that his type of *obsoleta* was collected by Dr. Erik Nyman, the Swedish botanist, and sent to Upsala. He notes that the type locality Simbang was a mission station on a hill 50 metres above sea level in a bay at a river outlet. The two specimens examined by me agree closely with the type description except for two points: "tympanum is completely covered by the granular skin so that no trace of it can be seen outwardly", and vomerine teeth "small". Loveridge (1935:50) disposes of the first difficulty when he says that his 19 specimens, collected by P. J. Darlington at a height of about 4000 feet on Mt. Spurgeon, present both hidden tympana and others very small about a quarter the diameter of the eye. The frogs ranged from juveniles to one of 67 mm. As to the vomerine elevations those of R.10980 and J.5570 are definitely large. Both elevations and descriptive terms may vary to some extent, but it seems safer to retain *nannotis* as a Queensland race. Loveridge (1935: 50) places *nannotis* in the synonymy of *obsoleta*, stating "these frogs tally so closely with Lönnberg's description of *obsoleta* and also Andersson's description and figure of *nannotis* as to leave no doubt in my mind that the latter is a synonym of the former".

HYLA EWINGII EWINGII Duméril and Bibron.

Synonymy and references.—*Hyla ewingii*: Duméril and Bibron (1841: 597); Jacquinot and Guichenot (1853: 26); Günther (1858: 111; 1867: 56); Boulenger (1882: 406); Fletcher (1898: 661, 665-673); English (1910: 632); Nieden (1923: 230); Lord and Scott (1924: 102); Blanchard (1929: 324); Scott (1942: 5). *Hyla e. ewingii*: Loveridge (1935: 45).

There is a large number of general references—most of which cannot be definitely classified under the headings of the subspecies—and more or less general discussions which will be most convenient to list here. This list should also be consulted when dealing with the separate races. *Hyla ewingii*: Duméril (1853: 171); Jacquinot and Guichenot (1853: 26); Günther (1858: 111; 1867: 56); Boulenger (1882: 406); Fletcher (1889: 359, 364-5, 367-8, 370, 382, 387; 1890: 670-1, 673; 1891: 274; 1892: 7, 8, 12-16; 1893b: 522; 1894: 527-8, 530-1; 1898: 661, 665-673, 681-2); Lucas (1892: 59, 61; 1896: 47); Spencer (1892: 21); Lucas and le Souef (1909: 295); Andersson (1913: 23); Fry (1915: 60); Nieden (1923: 230); Waite (1929: 260); Loveridge (1935: 44-48).

Duméril and Bibron's original description (1841: 597) reads: La Rainette D'Ewing. *Hyla Ewingii*. Nobis. Caractères. Dents vomériennes situées entre les arrière-narines au niveau de leur bord postérieur, sur une courte rangée transversale largement interrompue au milieu; dessus de la paupière supérieure et haut des côtés du tronc, tuber-

culeux. Une vessie vocale chez les mâles. Description. Formes. Les particularités exprimées dans la phrase précédente, sont les seules que présente la Rainette d'Ewing, examinée comparativement avec la Rainette de Lesueur. Coloration. Cependant son mode de coloration n'est pas non plus le même. Les parties supérieures offrent un gris verdâtre. A partir des yeux, la tête, en arrière, et toute la région dorsale sont marquées de petits points noirs si rapprochés les uns de autres, qu'on croirait voir une large bande noire s'étendant depuis le front jusqu'aux reins. Le museau porte, à droite et à gauche, une raie noire qui, commence à sa pointe et se termine à l'angle antérieur de l'oeil. La tempe est colorée en noir, et il existe une ligne blanche sous l'oeil et le tympan. Le dessus des pattes est pointillé de brun foncé. Toutes les régions inférieures sont jaunâtres. Dimensions. Tête. Long. 1" 4^{mm}. Tronc. Long. 2" 4^{mm}. Membr. antér. Long 2". Membr. postér. Long. 4" 8^{mm}. Patrie. Cette espèce se trouve à la terre de Van Diémen. Nous en possédons un échantillon qui nous a été donné par la société zoologique de Londres, dans le Musée de laquelle il y en a plusieurs autres qui proviennent d'un don fait par M. Ewing.

Description of R.7603 in the Australian Museum, an adult female, Ulverstone, Tasmania (J. J. Fletcher), probably collected in October, 1897, presented February, 1922:

Habitus stout and squat; total length of head and body 38 mm.; head subtriangular, very little broader than long (12 × 11.5 mm.); snout short (5 mm.), 1.25 times diameter of eye (4 mm.), bluntly rounded when seen from above, slightly rounded in profile, extending very little beyond lower lip, but the nostril is so far forward that it is vertically above lip; canthus rostralis short, slightly curved, moderately angular; lores slightly concave, oblique; interorbital width much greater than that of an upper eyelid (4 to 2.5 mm.), the top of the head flat between prominent eye bulges; internasal space 2.75 mm.; diameter of the eye much more than its distance from nostril; tympanum small, flat, only moderately distinct, tilted slightly upwards, contained twice in diameter of eye (2 to 4 mm.), distance from eye 1.5 mm.; a distinct supratympanic fold from eye bending over tympanum to above shoulder.

Skin smooth, but with a few scattered, low, small warts; chin and throat granular; ventral surfaces of body and thighs coarsely so; a very wide triangular extension of the granular area up to vent behind the thighs; limbs mainly smooth, except for a few warts behind the tarsus and forearm; no pectoral fold; anal flap very small.

Forelimb rather powerful and long (27 mm.), 70% of length of head and body; hand 13 mm.; finger discs well developed, rounded but a little wider than long, slightly larger than tympanum (2.25 to 2 mm.); fingers in order of length, 1, 2, 4, 3; webbing between the fingers not extensive, but distinct, amounting to 20, 17 and 17%; no fringes; subarticular tubercles rounded, low but distinct; palm coarsely granular; thumb somewhat enlarged basally.

Hindlimb moderately strong and long, length (68 mm.) 179% of head and body; femur 18 mm., tibia 20 mm., foot 30 mm.; heel reaches to between eye and nostril; toe discs moderately developed, a little wider than long, equal in size to tympanum (2 mm.); toes in order of length, 1, 2, 3=5, 4; extent of webbing between toes, 45, 45, 59 and 62%, web well away from all discs; narrow fringes; subarticular tubercles rounded and small, but distinct; sole slightly granular; a large, oval inner metatarsal tubercle; no outer one, but a small elevation in line with junction of 3rd and 4th toes.

Vomerine elevations paired, rather small, slightly oblique, well separated from each other and from the still smaller choanae, between the choanae, just touching the line joining the anterior borders of these openings and about half behind the line joining the posterior borders; tongue heart-shaped, free and quite deeply nicked behind.

Dorsal ground colour light brown. A wide blackish bar, including a pale patch in the centre, joins the eyelids. The bar continues back as a wide black band the same width to the end of the body. The band is separated into two for the posterior three-quarters of its length by a fairly wide light brown vertebral stripe, which begins at the level of the forelimbs. A distinct black stripe runs from the nostril under the canthus rostralis to the eye and then backwards, including the tympanum and supra-

tympanic ridge, to above the shoulder. There is a very conspicuous white stripe under this black one from beneath the eye to over the shoulder. The sides are light brown with obscurely patterned dark mottling, which is very inconspicuous. There is some dark on the limbs, and a row of light spots behind the forearm. Ventral surfaces are uniform yellowish, except that the chin is somewhat dark. The dorsal colour extends quite widely over the granular area behind the thighs, which are otherwise clear yellow except for a few small rather indistinct brown spots on each side.

Specimens examined and Locality Records: 10 (R. 4402, A.M.) Hobart, T. (E. J. Goddard), Mar., 1909; 2 (R.5260, A.M.) T. (R. Helms); 1 (R.6046, A.M.) Launceston, T. (Q. Vic. Mus.), Jan., 1913; 2 (R.6070-1, A.M.) Flinders Id., Bass Strait (J. B. Cleland); 2 (R.7469, A.M.) Port Sorel, T. (J. J. Fletcher), Feb., 1922; 9 (R.7470, R.7603-R.7610, A.M.) Ulverstone, T. (J. J. Fletcher), Feb., 1922; 5 (R.8396, R.8403, R.8411, R.8419, A.M.), T. (J. J. Fletcher), 12.x.1897; 2 (R.9500-1, A.M.) Interlaken, T. (G. P. Whitley), 24.i.1928; 4 (R.9830, A.M.) Cradle Valley, T. (F. N. Blanchard), 15.iii.1928; 1 (R.10073, A.M.) Cascades, T. (M. Ward), Jan., 1930; 2 (R.10955, A.M.) Dinorlan, T. (M.C.Z.), 1933; 1 (R.12121, A.M.) Pieman's Ridge, N.W. T. (Consett Davis); 8 (R.12122, A.M.) Lake St. Clair, T. (Consett Davis); 1 (D.7921, N.M.) Kingston, T. (C. Oke), 17.v.1948.

All specimens listed have been examined.

Variation.—The wide blackish band which starts in the bar joining the eyelids and runs the whole length of the body is typical of *H. e. ewingii*. It occurs in 12 of the 30 adult specimens examined (18 juveniles and the two dried Dinorlan frogs are excluded here) with a white or near white vertebral stripe dividing it much as in R.7603—the Ulverstone individual used in the standard description. The dark band is very distinct in another 12 frogs but the median stripe is much less extensive and well defined. The band is to some extent obscured in two of these 12 frogs, which have almost the whole of the dorsum very dark. Five frogs are almost plain dorsally, but what is typically the dark area is strongly outlined with black spots, and in one case a short dorsolateral black stripe posteriorly on each side. Only one specimen completely lacks the distinctive pattern, being uniform pale grey. The black line from the nostril through the eye and tympanum is always present, but is not so distinct in bleached specimens. The silvery, white or yellow stripe under the eye to over the shoulder is always conspicuous. Black spotting on the back besides the dark band is very variable. There are no spots in eight specimens, odd flecks on nine, a moderate number on eight, while five are very heavily dotted and spotted with black, one Interlaken frog especially so. The sides of two are plain, 13 resemble R.7603 in having obscure markings, nine have a few large irregular patches on the groin and posterior parts of the thighs, and six are heavily spotted. The posterior surfaces of the thighs are plain clear or greyish-yellow with a few indistinct brown spots in 18 specimens; quite plain in three; with small speckles in one; large irregular spots in six; while two are plain except for two or three large more or less confluent blackish spots dorsally. Eighteen juveniles from Hobart and Lake St. Clair have their markings very distinct, the thighs behind plain yellow or light brown, and the webbing very restricted. The white line from under the eye is very conspicuous in even the smallest individuals. Twenty-two frogs have the back smooth except for an odd, low, small wart, six are moderately warty, while four are decidedly warty all over. In a few cases the fingers are almost free of webbing, but it is quite distinct in most. Three Cradle Valley and three Ulverstone frogs are webbed at least a quarter between the 3rd and 4th fingers. Webbing of the toes is well away from the discs in all but two, where it is close. Finger discs are well developed, especially in large adults. Apparently delayed growth of the discs continues after that of the tympanum. Fifteen frogs have the discs equal in size to the tympanum, 11 are smaller and only four larger. Toe discs are smaller in 25 specimens, equal in five. Vomerine elevations are very much of a pattern. They vary slightly in size, as do the choanae. Occasionally they are quite contained between the choanae. A few are practically transverse, but they are always separated. R.6070 and R.8411 have them small and rounded, R.8403 rather large and rounded, while in R.9500 they are virtually absent.

Discussion.—The nominate race has the wide dorsal band well developed with a light vertebral stripe; the light stripe under the eye to over the shoulder is conspicuous; and the sides differ from *verreauxii* and *iuxtaewingii* in lacking the prominent black blotches of the sides; spotting when present is more obscure and not so well defined. There is no trace of the dorsal markings characteristic of *alpina* and *loveridgei*. English (1910: 632) says *e. ewingii* is "very abundant in most parts of Tasmania" and describes its habits. He noted that "in January, 1902, I found a specimen at Westbury which had some bright green patches on its back. The colour of these patches seemed fixed". Lord and Scott (1924: 102) describe breeding habits and ecology. They remark that the numbers of the frog fluctuate and record "Some years ago the waters of Lake Tiberias were unusually high, and upon their return to normal limits enormous numbers of these frogs were stranded in pools (in the frog stage), and dead bodies of those whose pools had evaporated too quickly to enable change from tadpole to adult stage were strewn all over the shore". Scott (1942: 5) gives some interesting notes on history and occurrence. Loveridge (1935: 45) discusses diagnostic characters and notes *ewingii*'s similarity to *jervisiensis*. Fletcher's general discussion (1898: 665-) should be noted. He gave a careful examination, but according to the view here made an unnecessary subdivision of Tasmanian frogs into "the typical unspotted form of *H. ewingii*, together with a slight and unimportant colour-variety, and var. *A. var. calliscelis*".

HYLA EWINGII IUXTAEWINGII, subsp. nov.

Specimens examined and Locality Records: 10 (A.C.5661-70) 18 m. W. of Bairnsdale, V., 28.xii.1955; type A.C.5666, a male; 1 (D.6723, N.M.) Darby, Wilson's Promontory, V.

Variation.—All specimens retain the wide dark dorsal band typical of *ewingii* and a vertebral light stripe is always present. They have no trace of the pronounced dorsal markings of *alpina* and *loveridgei*, but are boldly blotched with black on the sides much as *verreauxii*. Posterior surfaces of the thighs are clear yellow in alcohol with no large dots but some fine speckling. In life the thighs were bright orange before and behind. The light vertebral line is interrupted by a narrow dark crossbar between the eyes. Backs are somewhat warty. The snout is short and the tip truncate. D.6723 has the colour pattern not so well marked, otherwise the 11 specimens closely resemble each other. Vomerine elevations in nearly all are partly behind the choanae; a few are oblique and others rather small. Five males have blackish chins and the same colour extends to some extent on to the throat.

Discussion.—This race has been named to include specimens from southern Victoria intermediate between *H. e. ewingii* and *H. e. verreauxii*. They have the typical dorsal colour pattern and habitus of *ewingii*, but differ from that race in having black blotches on the sides in which they resemble *verreauxii*. They differ from the latter in having the snout shorter and the tip more truncate. In *verreauxii* the snout is markedly more pointed. *Iuxtaewingii* is also intermediate in wartiness between the Tasmanian and New South Wales subspecies.

HYLA EWINGII VERREAUXII Duméril.

Synonymy and references.—*Hyla verreauxii*: A. Duméril (1853: 171); Günther (1858: 115); Fletcher (1889: 387; 1892: 11, 14; 1894: 525; 1898: 660, 671-2). *Hyla ewingii*: Krefft (1864: 389); Keferstein (1868b: 283); Steindachner (1867: 62); Marriner (1907: 145). *Hyla krefftii*: Günther (1863b: 28; 1863a: 250); Keferstein (1868a: 357; 1868b: 280); Boulenger (1882: 407); Fletcher (1889: 367, 383-4; 1890: 670-1; 1892: 15; 1894: 530; 1898: 661, 666, 668-73); Nieden (1923: 230). *Hyla ewingii* var. *orientalis*: Fletcher (1898: 670 etc.). *Hyla ewingii verreauxii*: Loveridge (1935: 46).

Duméril's original description (1853: 171) reads: Rainette de Verreaux. *Hyla Verreauxii*, A. Dum., espèce nouvelle. En cherchant les analogies de ce Batracien avec les autres espèces du même genre, on voit qu'il n'a pas les doigts des membres antérieurs palmés, tandis qu'aux pieds, ils sont presque entièrement réunis par une membrane natatoire. Le dos est lisse, ainsi que la tête, et le tympan est bordé supérieurement par un cordon glanduleux. Ces caractères, qui sont ceux que les auteurs de

l'Erpétologie générale ont pris en considération dans le tableau du genre *Rainette*, montrent que celle-ci se rapproche surtout de la *R. de Lesueur*; mais, outre les différences dans le système de coloration, cette dernière a les disques digitaux moins développés que l'espèce nouvelle, qui peut être caractérisée ainsi: Caractères.—Tête courte et assez épaisse; museau non arrondi et formant un angle à sommet obtus; canthus rostralis saillant; narine percée au-dessous de son extrémité antérieure; région frénale haute et concave; tympan beaucoup plus petit que l'oeil; dents vomériennes situées positivement entre les arrières-narines et en chevron; langue grande, un peu échancrée à son bord postérieur. On acquiert facilement la certitude que la désignation de *Hyla nova species*, inscrite par Bibron sur les Catalogues, est exacte, si l'on tient compte des remarques suivantes sur les différentes *Rainettes* de l'Océanie décrites jusqu'ici, et à aucune desquelles l'espèce nouvelle n'appartient. Ainsi, la *R. bleue* a les dents vomériennes situées au niveau du bord postérieur des narines; chez la *R. de Jervis*, elles sont exactement sur le même niveau que le bord antérieur de ces orifices. La tête de la *R. de Jackson* est plus allongée, ses narines sont moins rapprochées du bout du museau; elle porte d'ailleurs, de chaque côte du dos, un cordon glanduleux. La *R. crocopode* n'a une palmure entre les orteils qu'à leur base. L'un des caractères distinctifs principaux de la *R. d'Ewing* se tire de la présence de tubercules sur le dos, sur les flancs, au-dessus des yeux et sous la gorge, et très apparents chez les femelles. Elle a, de plus, le museau un peu plus obtus. La *R. de Péron*, enfin, a le museau plus arrondi, les yeux plus saillants et le tympan moins petit; puis les dents vomériennes sont en rang transversal. Voici, au reste, un petit tableau destiné à montrer comment on peut distinguer entre elles les *Rainettes* que le Muséum a reçues de l'Océanie.

Doigts.	palmés ; derrière la bouche un cordon glanduleux.	apparent nul ; coloration	R. de Jervis.		
			uniforme à marbrures	R. bleue.	
				R. de Péron.	
	non palmés mais orteils palmés	presque entièrem- ent ; dos	rugueux par	un semis de petits tubercles	R. d'Ewing.
					des cordons glanduleux
			lisse ; épatements digitaux	grands	R. de Verreaux.
					médiocres
				à leur base seulement R. crocopode.	

L'espèce nouvelle est, en outre, caractérisée par son système de coloration. Les régions supérieures sont d'un brun assez foncé, et souvent parcourues, depuis l'espèce interorbitaire, jusqu'au cloaque, par une large bande d'un brun sombre, dont la portion médiane, chez quelques individus, est plus claire. On voit une bande à peu près semblable chez la *R. d'Ewing*; mais cette dernière a toujours la région temporale transversée par une bande noire étendue de la narine à l'épaule, et bordée, en dessous, par une ligne jaune très fine et plus courte. Cette particularité manque chez la *R. de Verreaux*, dont les flancs sont piquetés, de jaune, et les régions inférieures d'un blanc jaunâtre. L'examen comparatif d'une nombreuse série d'individus des deux sexes et de différents âges, ainsi que d'une série de *R. d'Ewing* également rapportée de l'Australie par M. J. Verreaux, montre que, malgré de certaines analogies, ces divers échantillons appartiennent à deux espèces distinctes, différenciées surtout par les tubercles cutanés très apparents chez toutes les *R. d'Ewing*, et qui manquent constamment dans l'espèce nouvelle. Celle-ci, d'ailleurs, n'a pas sur le dos le piqueté noir qu'on voit le plus habituellement chez l'autre.

Specimens examined and Locality Records: 1 (R.6325, A.M.) Gurravembi, Nambucca River, N.S.W. (D. B. Fry and H. E. Smart), Oct., 1913; 10 (R.7503-5, R.8407, A.M.) Lucknow, near Orange, N.S.W. (J. J. Fletcher), Feb., 1922; 2 (R.7589, A.M.) Burrawang, N.S.W. (J. J. Fletcher), Feb., 1922; 4 (R.8339-40, A.M.) Ballarat, V. (J. J. Fletcher),

July, 1924; 2 (R.8397, A.M.) Wentworth Falls, N.S.W. (J. J. Fletcher); 3 (R.8398, A.M.) Inverell, N.S.W. (J. J. Fletcher), 29.viii.1924; 3 (R.8401, A.M.) Bungendore, N.S.W. (J. J. Fletcher); 1 (R.8404, A.M.) Kurrajong Heights, N.S.W. (J. J. Fletcher); 1 (R.8405, A.M.) Bowral, N.S.W. (J. J. Fletcher); 4 (R.8408-9, A.M.) Warragul, V. (J. J. Fletcher), 29.viii.1924; 2 (R.8413, A.M.) Stanmore, near Sydney, N.S.W. (J. J. Fletcher), 29.viii.1924; 22 (R.8504, A.M.) Avoca, N.S.W. (T. Steele), Nov., 1924; 3 (R.9485-7, A.M.) Koonadan, Leeton, N.S.W. (K. C. McKeown), Mar., 1928; 1 (R.9947, A.M.) Brooklana, East Dorrigo, N.S.W. (W. Heron), 24.vi.1929; 1 (R.10771, A.M.) Tamworth-Walcha Road, N.S.W. (K. C. McKeown), Nov., 1932; 1 (R.12080, A.M.) Palmdale, Wyong, N.S.W. (J. H. Wright), 1937; 4 (R.13389, R.13391, A.M.) Bowenfels South, N.S.W. (Kinghorn and MacKay), 1948; 1 (R.14358, A.M.) Spencer's Creek, Mt. Kosciusko, N.S.W. (A. Musgrave), 17.vii.1953; 6 (R.14493-4, 14519-22, A.M.) Colo Vale, N.S.W. (H. Cogger), June and Aug., 1955; 14 (R.14530, A.M.) Killara, N.S.W. (J. Moore), tadpoles from eggs, 3.viii.1952; 2 (7080, A.M.) Port Macquarie, N.S.W.; 2 (R.3742, S.M.) Armidale, N.S.W. (R. Pengilly), Aug., 1955; 2 (A.C.35-6) Kilbride, near Campbelltown, N.S.W., 22.viii.1938; 3 (A.C.133-5) Upper Cordeaux Dam, N.S.W., 25.ix.1938; 1 (A.C.152) Gerringong, N.S.W., 2.x.1938; 1 (A.C.201) near Appin, N.S.W., 13.xi.1938; 2 (A.C.415, 417) Tallong, N.S.W., 22.v.1939; 7 (A.C.426, 428-31, 434, 438) 15 m. N. of The Oaks, N.S.W., 10.i.1939; 11 (A.C.494-5, 499, 500, 502-5, 508, 511-2) Bundanoon, N.S.W., 21.v.1939; 1 (A.C.2238) near Armidale, N.S.W. (Consett Davis), 8.v.1944; 1 (A.C.4534) Kangaroo Valley, N.S.W., 5.xii.1949; 1 (A.C.4828) Warrawee, N.S.W., 3.viii.1950; 1 (A.C.5093) Ben Lomond, N.S.W., 26.xii.1954; 2 (A.C.5534, 5885) near Bombala, N.S.W., 26.xii.1955; 11 (M.C.Z. specimens) Smithfield, Berridale, Mt. Kosciusko (5000 ft.), Tamworth and Glen Innes?, all N.S.W., and Warragul, V., vide Loveridge (1935: 46).

Variation.—The dorsum is smooth, except for the usual presence of a few small warts, mainly between the eyes. The wide dark band from between the eyes to the end of the body about as wide as the distance between the eyes is generally distinct. It may be uniform or there may be a more or less conspicuous median light line. The vertebral stripe may become obscure and the dark band spread so that the whole dorsum is rather uniform darkish. Although the dorsum is sometimes fairly plain there are practically always vestiges of the dark band. In R.8339, a large individual measuring 37 mm. from snout to vent, the dark band is only suggested by a few dots and according to a field note by W. W. Froggatt there was "green on back in life". The groins and sides are blotched or spotted. The blotches on the sides are typically few, large and rounded, and there is no oblique bar on the flank as in *alpina*. The blotches sometimes break up into a number of smaller dots. An Armidale frog has one side almost plain but the other well blotched. Two Leeton frogs are unusual in having a speckled dorsum and the sides with many small dots and speckles; they also have dark dots behind the thighs and are covered with small, pin-point warts. One Warragul frog is also heavily speckled with dark all over the back. A.C.4828, though undoubtedly of this race, is abnormal in having a practically grey back peppered with hundreds of tiny black dots. Posterior surfaces of the thighs usually are quite plain or have a few obscure dark patches. There is some variation and often proximal speckling or even a few dots. The Kurrajong Heights frog and one from Bundanoon have a few bold black markings behind the thighs, which is most unusual and possibly a recessive condition. A white streak from over the eye joins one from under the eye over the shoulder to enclose the black line from the tip of the snout, through the nostril and eye to above the shoulder; but this pattern is not so conspicuous as in *alpina*. The lower white line is always present, but the upper one may be indistinct. The vomerine elevations are typically small, rounded, well separated, and on a line joining the anterior edges of the choanae. They are generally totally between or slightly projecting in front of the choanae. A few are a little oblique, and others may project behind, in one or two extreme cases nearly as much as half. One of R.8408 has the elevations exceptionally large and oblique, but the other is typical, small and totally between the choanae. The fingers are normally practically free of web, but

there is often some webbing between the 3rd and 4th which in a few cases reaches 20%. No toe is webbed to the disc; there is generally a quite wide or at least distinct gap to the disc, but in R.9485-7 all toes except the 4th are nearly webbed to the disc. The size of the largest finger disc is normally little more than half the diameter of the tympanum, but in some it is three-quarters. The heel reaches to the eye. The posterior surfaces of the thighs are generally orange in life.

Discussion.—*H. e. verreauxii* is here taken to include all members of the species from eastern New South Wales with typically blotched sides and flanks, with the exception of *alpina* and *loveridgei* on the highlands. Almost certainly *calliscelis* is to be found in the south-west of the State. Fletcher (1892: 15) said "as far as my experience goes, *H. ewingii* is represented in N.S.W. only by var. *calliscelis*". Later (1898: 665) he gives a detailed and well-reasoned analysis of the systematics of *ewingii* in a review extending over eight pages. He points out how much variation there may be in specimens from the same locality and deals fully with colour variation, webbing and other characters. He says "if *H. ewingii* may comprehend var. *orientalis*, which is less webbed, it would obviously be illogical to exclude a variety (var. *krefftii*) because it may be a little more webbed". He had seen about 75 specimens of *krefftii* from within 60 miles of Sydney and considered it a rare frog confined to the coast; but that *orientalis* was one of the commonest frogs on the coast and tablelands. Fletcher had a single specimen from the Mt. Kosciusko plateau, which was probably *loveridgei*. He discusses *verreauxii* and concludes "*verreauxii* was in all probability founded on smooth specimens of *H. ewingii*". Fry with additional material, mainly *alpina*, reworked Fletcher's specimens and came to slightly different conclusions. Both papers are too long to be dealt with thoroughly here, but they should be consulted. Their main conclusions have been modified and adopted. There does not seem to be the slightest doubt that Duméril's *verreauxii* is the appropriate name for this form. This was first pointed out by Loveridge (1935: 46), who gives a very clear analysis of the *ewingii* problem. Günther (1858: 111 and 1867: 56) includes north-east Australia in the range of *ewingii* and mentions two specimens, one from Rich's collection. Fry (1915: 82) questioned these records. It seems best to include *krefftii* in the synonymy of *verreauxii* on the basis of Günther's description. Boulenger (1882: 407) says *krefftii* is very close to *H. ewingii*, but differs in more distinct webbing of the fingers and toes. Günther says "Fingers one-fourth webbed, with the discs of moderate size; toes broadly webbed". He later (1863a: 251) noted that the sides were light reddish olive and covered with minute brown dots like the back. Krefft (1864: 389) says of *Hyla verreauxii* "a rather rare frog, which I have occasionally taken from under the bark of the Tea-tree, and from under rocks in moist localities, never taken during the summer", and of *H. krefftii* "a very common species all over the eastern part of Australia". Krefft continues to describe voice and habitat and adds "before and during rain, thousands of these little creatures begin to whistle . . .". Keferstein (1868b: 283) described a typical N.S.W. *ewingii* and said that the fingers were free, whereas those of *krefftii* (p. 280) had a small web. Loveridge, as noted under *jervisiensis*, included *krefftii* in that species. The races of *ewingii* are discussed more or less comprehensively and general descriptions given by Boulenger (1882), Fletcher (1898), Andersson (1913), Fry (1915) and Loveridge (1935). Marriner (1907) notes that *ewingii* has been introduced into New Zealand.

HYLA EWINGII ALPINA Fry.

Synonymy and references: *Hyla ewingii*, var. *alpina*: Fry (1915: 79). *Hyla ewingii alpina*: Loveridge (1935: 47).

Specimens examined and Locality Records: 2 (A.C.1543-4) Mt. Kosciusko, N.S.W., 2 m. from Summit, 21.i.1943; 1 (A.C.2131) 5 m. S. of Kiandra, N.S.W., 5.xii.1943; 2 (A.C.5517-8) Snowy River, near Summit, Mt. Kosciusko, N.S.W., 24.xii.1955; 3 (R.581, R.583-4, A.M.) Mt. Kosciusko, 5500 ft. (R. Helms), May, 1889 (cotypes); 12 (R.4644-6, A.M.) Mt. Kosciusko (Charles Hedley), Feb., 1910 (type R.4644, and cotypes); 3 (R.5055-6, R.5058, A.M.) Mt. Kosciusko, 7000 ft. (T. H. Johnston) (cotypes); 3 (R.5422, R.5424-5, A.M.) Hotel Kosciusko, 5200 ft. (A. R. McCulloch), Dec., 1911 (cotypes);

9 (R.7433-8, A.M.) Pretty Point, Mt. Kosciusko (J. J. Fletcher), Feb., 1922; 1 (R.10922, A.M.) Daner's Gap, Mt. Kosciusko, 5400 ft. (M.C.Z., Darlington), 1932; 1 (R.10972, A.M.) Etheridge Range, Mt. Kosciusko (M.C.Z.), 1933; 1 (R.13773, A.M.) Daner's Gap, Mt. Kosciusko, 5400 ft. (Q.V.M.), 12.xii.1931; 2 (R.13775, A.M.) Etheridge Range, Mt. Kosciusko, 6500 ft. (Q.V.M.); 1 (M.C.Z.18055) Dead Horse Ridge, Mt. Kosciusko, 6600 ft. (W. E. Schevill), 1931; 39 (M.C.Z.18056-69) S. of Etheridge Range, Mt. Kosciusko, 6500 ft. (W. E. Schevill), 1931; 27 (M.C.Z.18070-9) Daner's Gap, Mt. Kosciusko, 5400 ft. (W. E. Schevill), 1931; 1 (M.C.Z.19055) Mt. Kosciusko, 7000 ft., cotype (T. H. Johnston), 1933. The last four entries are from Loveridge (1935: 47).

The 40 A.M. and A.C. specimens have all been examined.

Fry's original description (1915: 79) reads: *Hyla Ewingii*, D. and B. var. *alpina*, var. nov. (Plate III, fig. 2, Text fig. 4). *Hyla ewingii* v. *orientalis*, Fletcher, Proc. Linn. Soc. N.S.W., xxii, 1898, p. 670 (part). Habit moderate. Head two-thirds as long as broad, the measurement taken at a line drawn between the hinder margins of the tympana. Snout rounded, a little longer than the orbital diameter; nostril elevated, slightly nearer the tip of the snout than the eye; canthus rostralis distinct; loreal region very oblique, concave. Tympanum upright-oval, perfectly distinct, separated from the eye by a distance equal to its own diameter, which is half to two-thirds that of the orbit. Interorbital space almost as broad as the upper eye-lid. Tongue broadly shield-shaped or oval, slightly nicked behind. Vomerine teeth in two fairly large, oblique, sometimes contiguous groups, between the choanae. Limbs normal. Fingers tapering, with a very fine fringe which is very slightly enlarged at the bases between them so that it might be said that a rudiment of web is present; if anything, this is best developed between the first and second and second and third fingers; first finger slightly shorter than the second; discs swollen, but not enlarged, a little more than half the transverse diameter of the tympanum; sub-articular pads tubercular; several rows of tubercles on the metacarpals; a large tubercle on the inner side of the base of the first finger which may bear a brown rugosity in breeding males. Toes moderate, not webbed to the discs; the third and fifth about three-quarters, the fourth about two-thirds webbed, the fringe continuing to the discs; the latter small, if anything smaller than the finger discs; a well developed inner metatarsal tubercle, in adult specimens of quite an unusual size for a *Hyla*; sub-articular tubercle distinct and a row of smaller tubercles on the under side of the phalanges and metatarsals. Tibio-tarsal articulation of the out-stretched limb reaching to the eye. Skin of back and limbs warty above, the vertebral region grooved and usually devoid of warts. The warts usually commence with a distinct line of demarcation, between the eyelids and sometimes border the tympanum posteriorly. A distinct glandular fold above the tympanum and also on the inner side of the tarsus; sides sometimes plicate. A distinct fold across the chest. Gular region, chest, belly, underside of thighs and arms coarsely granular. Colour (spirits): Light olive green or purplish brown above, almost uniform or with dark bands which may be broken into isolated spots. Usually two broad brown bands commence between the eyes and continue to the sacral region, separated along the vertebral line. Sides with a chain of large blackish light-edged spots, the largest in the inguinal region running obliquely from the back to the groin. A narrow brown light-edged streak commences on the tip of the snout and borders the canthus to the eye; from the posterior border of the eye, whence it becomes much broader, it passes through the tympanum to the shoulder. Upper surfaces of arms and legs variously blotched and spotted with brown. Some specimens are almost uniform greenish above, the bands being so broken as only to be represented by a few isolated spots, in which case a very large inguinal spot is always present. Under-surfaces uniform creamy yellow. The life colours of this frog are truly beautiful. The whole of the upper-surfaces may be either suffused with olive green or uniformly of the purest of pea-greens. The brown bands and spots do not change to any great extent when put into alcohol, but the green almost entirely disappears. The under-surfaces are lemon yellow. The resemblance of this frog to *Hyla regilla*, Bd. and Gir., of North America, as regards its life colours, is worthy of note. *H. regilla* has been beautifully figured by Miss Mary C. Dickerson (The Frog

Book, New York, 1907, col. pls., viii-ix), two plates showing clearly the enormous range of colour and marking displayed by different individuals, many phases of which forcibly suggest those of *H. ewingii* v. *alpina*. Length of head, to hinder edge of tympana 12 mm.; width of head at tympana 17 mm.; total length, snout to anus 48 mm.; length of hindlimb to tib-tars. art. 41 mm. Locs.: Twenty-two specimens from Mt. Kosciusko, Monaro District, Southern tableland, New South Wales. Three specimens collected by Mr. A. R. McCulloch were taken at an altitude of 5200 feet. Mr. Charles Hedley and Mr. Robert Helms have taken them at 5500 feet, while four collected by Dr. T. H. Johnston are said to be from 7000 feet altitude. I have to thank Messrs. Hedley, Johnston and McCulloch for their kindness in bringing me specimens alive. This new variety can be distinguished from the other varieties of *Hyla ewingii*, D. and B., by its warty back, scarcity of webbing, small discs and tapering fingers, and by the predominance of green in its life coloration. As regards the amount of webbing and size of the finger discs, however, var. *alpina* overlaps some examples which are true specimens of var. *orientalis*. Type: in the Australian Museum, Reg. No. R.4644.

Variation.—All specimens are very warty, and may be extremely so, especially on the sides. They have heavy black longitudinal stripes and markings dorsally and laterally. In R.5055 the stripes break up into chains of large heavy dots. There is usually a wide and extremely distinct vertebral line. A bold oblique bar down each flank is typical; it is usually confluent dorsally with one of the black stripes. There is often a white triangular area on the head between the eyes and the tip of the snout. A white band from over the eye joins one from below the eye over the shoulder to enclose a prominent blackish stripe from the nostril through the eye to over the shoulder. This pattern is nearly always very distinct. Anterior and posterior surfaces of the thighs are generally clear yellow or brownish. There may be an odd obscure spot or one or two usually small dots, but A.C.5518 has a few large black markings behind the thighs. White granules may occur near the vent. Nearly all the ten R.4646 juveniles show the conspicuous vertebral stripe. Vomerine elevations are typically moderate, transverse, close together and between the choanae. R.5058 has them large, slightly oblique and partly behind the choanae. The finger discs are practically not dilated at all, or they may be slightly enlarged to a third or even half the size of the tympanum. Fingers are free, and the web does not nearly reach any toe disc. Frogs in life are nearly always green dorsally. This seems to become more pronounced with height, for instance A.C.5517-8 collected at about 6300 feet not far from the summit of Mt. Kosciusko were a practically uniform bright green. A.C.2131 was dorsally yellowish-grey and black.

Discussion.—Fry gives considerable detail in his original description, so comment on this very distinctive race has been cut to a minimum. He emphasizes diagnostic features of his 22 specimens all taken at 5200 ft. or at higher altitudes on Mt. Kosciusko. Fry includes Fletcher's *orientalis* in part in his *alpina*, but although Fletcher (1898: 670) says "less webbed than the typical form" and "discs of both the fingers and the toes are certainly smaller than usual", his "a more widely distributed spotted variety" and "one of our commonest frogs on the coast and on the tablelands" rules out his name if only on the grounds of the limited range of *alpina*. Loveridge (1935: 47) discusses this form in association with *loveridgei*, which has a smooth back.

HYLA EWINGII LOVERIDGEI, subsp. nov.

Synonymy and reference: *Hyla ewingii alpina* (part): Loveridge (1935: 47).

Type, No. A.C.3023, near Porter's Retreat, N.S.W., 1.v.1946. The dorsum is smooth, the size large, and the colour pattern is similar to that of *alpina* with heavy longitudinal stripes on the back and heavy lateral blotching, including a prominent oblique black bar far back on the flank.

Specimens examined and Locality Records: 1 (A.C.728) near Hampton, N.S.W., 11.ii.1940; 1 (A.C.1594) Sawpit Creek, near Jindabyne, N.S.W., 23.i.1943; 4 (A.C.2490-3) Little Hartley, N.S.W., 19.xi.1944; 5 (A.C. 2946, 2998-3000, 3002) near Oberon, N.S.W., 30.iv.1946; 6 (A.C.3017-9, 3023-4, 3042) near Porter's Retreat, N.S.W., 30.iv-1.v.1946; 1 (A.C.4458) S. of Hampton, N.S.W., 4.iv.1949; 1 (A.C.5038) no data; 1 (A.C.5516)

4 m. W. of Berridale, N.S.W., 25.xii.1955; 1 (A.C.5566) Mt. Donna Buang, V., 31.xii.1955; 1 (A.C.5926) Adaminaby, N.S.W., 23.xii.1955; 11 (A.C.6087-6097) Jenolan State Forest, N.S.W. (Janet Copland), 14.v.1956; 1 (A.C.6101) 5 m. S. of Hampton, N.S.W., 14.v.1956; 1 (R.8409, A.M.) Warragul, V. (J. J. Fletcher), Aug., 1924; 1 (R.8417, A.M.) Yass, N.S.W. (J. J. Fletcher), 29.vii.1924; 2 (R.11549, A.M.) Oberon, N.S.W. (J. C. Wiburd), Apr., 1935; 4 (R.12494-5, A.M.) Australian Capital Territory (P. J. Mackerras); 4 (R.13089-90, A.M.) Barrington Tops, N.S.W. (R. Gaven); 1 (R.13310, A.M.) Pol Blue, Barrington Tops, N.S.W., 4900 ft. (W. Barnes), 14.i.1948; 5 (D.7708-7712, N.M.) Little River, Suggan Buggan, V.; 4 (D.8698-8701, N.M.) Mt. Baw Baw, V.; 1 (M.C.Z.18054) Barrington Tops, N.S.W. (P. J. Darlington), 1932; 13 (M.C.Z.18516-25) Hartley Vale, N.S.W. (P. J. Darlington), 1932. Last two records vide Loveridge (1935: 47).

Variation.—All specimens are large with the back smooth or practically so. Most frogs have very prominent black longitudinal markings along the back, and it is interesting that these are perhaps most conspicuous in individuals from the extreme limits of its range known at present—Barrington Tops and Victoria. The oblique bar down the flank, which usually springs from a longitudinal stripe, is almost diagnostic. However, it is indistinct in some Jenolan State Forest specimens though very prominent in others. It is practically always indicated at least. A vertebral stripe is normal. It appears plain and sunken in preserved frogs, but in life is nearly always green. The same colour may include most of the back and form patches on the sides. Heavy lateral blotching is characteristic, but it is occasionally reduced, as in four Jenolan State Forest frogs, to not very conspicuous black dots and patches. The anterior and posterior faces of the thighs are characteristically clear, plain yellow. The Mount Donna Buang specimen is unusual in having this clear area reduced by proximal black spotting and brown dotting. A.C.5516 is unique in having the black markings broken up into very many small scattered dots and streaks, and in being slightly warty. The vomerine elevations are between the choanae. They generally project a little in front and a little behind; but, when they are smaller than usual, they only project in front.

Discussion.—With the exception of *alpina*, *loveridgei* is the most distinctive of the *ewingii* group. It may at once be distinguished from *alpina* by the smooth or practically smooth dorsum, and from *verreauxii* by the bold dark colour pattern, which closely resembles that of *alpina* and almost invariably includes a prominent dark marking on the flank in the form of an oblique bar. The race is apparently confined to the highlands of New South Wales and Victoria, but at lower elevations than *alpina*. I have to thank Loveridge for suggesting that this form is distinct, and have indicated my debt by naming it after him. Loveridge (1935: 47) discusses his Barrington Tops and Hartley Vale frogs in connection with *alpina*. He noted that in one specimen "on the hinder side of the thigh a deep black streak and some dusky flecks on a yellow ground reminiscent of the markings of *H. jervisiensis*". The Jenolan State Forest frogs had the posterior surfaces of the thighs clear to bright yellow, quite plain in nine but with black markings in two. Black markings of the dorsum and sides were in life on a ground colour of bright brick red, clay yellow, or green.

HYLA EWINGII CALLISCCELIS Peters.

Synonymy and references: *Hyla calliscelis*: Peters (1875: 620). *Hyla ewingii calliscelis*: Boulenger (1882: 407); Lucas and le Souef (1909: 295); Andersson (1913: 23); Kinghorn (1924: 182); Waite (1929: 260); see also general heading.

Peters' original description (1875: 620) reads: *Hyla calliscelis*, n. sp. Kopf so breit wie lang; Canthus rostralis deutlich. Choanen klein, aber grösser als die Tubenöffnung. Vomerzähne in zwei queren Haufen zwischen den Choanen. Trommelfell rund, halb so lang wie das Auge. Finger nur an der Basis der beiden äusseren Finger und zwischen den Mittelhandgliedern des zweiten und dritten Fingers. An der hinteren Extremität lässt die Schwimmhaut die zwei letzten Glieder der vierten und das letzte der zweiten und fünften Zehe (ähnlich wie bei *H. Ewingii*) frei. Unterseite der Oberschenkel, Bauch und Brust gröber, Unterkinn feiner granuliert. Oberseite glatt. Oben bläulich grau. Eine dunklere, vorn grade Querbinde zwischen den Augen, welche sich nach hinten auf den Rücken ausdehnt. Eine dunkle Längsbinde unter dem Canthus rostralis.

Eine breite dunkle Binde durch das Ohr nach der Schulter; unter derselben eine unter dem Auge beginnende gelbliche Linie. In der Inguinalgrube ein blauschwarzer Fleck. Vorder- und Hinterseite des Oberschenkels orangegelb, letztere mit einigen grossen schwarzblauen Flecken. Totallänge 0,040; Kopf 0,0115; vord Extr. 0,022; Hand mit 3.

Finger 0,011; hint. Extr. 0,056; Fuss mit 4. Zehe 0,016. Zwei Exemplare aus Adelaide, durch Hrn. R. Schomburgk. Diese Art steht zwischen *H. Ewingii* und *H. Peronii*, der ersteren durch die geringe Entwicklung der Schwimmhäute und der schwarzen unten hell gasäumten Schläfenbinde, der zweiten durch die Stellung der Vomerzähne und die Färbung der Hinterseite der Schenkel sich anschliessend.

Specimens examined and Locality Records: 1 (R.5257, A.M.) S.A. (R. Helms), Feb., 1911; 2 (R.7128, A.M.) Birchmore Lagoon, 15 m. from Kingscote, Kangaroo I., S.A. (E. L. Troughton), May, 1920; 4 (R.7149, A.M.) Timber Creek, Kangaroo I., S.A. (E. L. Troughton), May, 1920; 4 (R. 7160, R.7163, A.M.) Deep Creek, 20 m. from Kingscote, Kangaroo I., S.A. (E. L. Troughton), May, 1920; 4 (R.8395, A.M.) Ballarat, V. (J. J. Fletcher), 29.vii.1924; 1 (R.8414, A.M.) Mt. Lofty, V. (sic, but probably S.A.) (J. J. Fletcher); 2 (R.3157, S.M.) Grampians, V.; Adelaide, type locality, vide Peters (1875: 620), and Andersson (1913: 23) one specimen, 16.x.1911 (E. Mjöberg); Kangaroo Island localities referred to by Kinghorn (1924: 182) see above.

The 18 A.M. and S.M. specimens have been examined.

Variation.—The posterior surfaces of the thighs have typically a few rather bold black markings on light brown or yellow. In long preserved specimens these areas may appear almost plain yellow with a few dots. The grey or light brown dorsum has generally a very distinct wide dark dorsal band from between the eyes to the back of the body. The band is edged with black or merely speckled. Sides are flecked. A trilobate light area on the head is enclosed between the dark bar between the eyes and black stripes from the snout on each side. Vomerine elevations are transverse and about on a line joining the anterior edges of the choanae. There is a distinct web between the fingers and no toe is webbed to the disc. The back is smooth or slightly warty. R.5257, a large specimen with snout to vent measurement 42 mm., is very boldly marked behind the thighs. The two Grampians frogs have the frontal lobe very distinct and the posterior surfaces of the thighs clear yellow.

Discussion.—Peters, who had two specimens from Adelaide, noted the finger webbing and markings behind the thighs. Günther (1867: 56), who mentions north-east Australia as a locality record, also gives King George's Sound on the basis of two individuals from Krefft. Boulenger (1882: 407) treats *calliscelis* as a variety with "hinder side of thighs with large purplish-black spots on yellowish ground; a purplish-black spot in the groin", and also gives King George's Sound (G. Krefft) as the locality for his two British Museum specimens. Andersson (1913: 23), who had a specimen from Adelaide, notes "in the groin a dark, although rather indistinct patch as well as some rather large purplish-black spots on the hind side of the thighs. These markings are absent in a specimen from Victoria . . ." He also discusses the species generally. Lucas and le Souef (1909: 295) note of *calliscelis* "inner side of legs is of a bright orange". Fry (1915: 82) regarded *calliscelis* as confined to South and Western Australia, and gave characteristics as finger discs as large or larger than the tympanum, more extensive webbing of fingers and toes, and by large very accentuated purple blotches on groin and hinder side of thighs. He remarks "the inguinal and thigh marks of *v. calliscelis* are very different in nature to those which occur in occasional instances in Eastern Australian specimens of *v. orientalis*, and do not vary among themselves to such an extent. They stand out in bold relief on a pale ground and resemble deep, even-edged, purple ink-blotches". Although the present author is satisfied with the status and treatment of *H. e. ewingii*, *e. alpina*, *e. loveridgei*, *e. verreauxii*, full treatment of *e. calliscelis* and *e. iuxtaewingii* and the species *Hyla jervisiensis*, *H. parvidens*, and *H. inguinalis* must await additional collecting and comparative work. At present *H. e. calliscelis* may be taken to include frogs from South Australia, western Victoria and islands off the coasts of those two States.

HYLA PARVIDENS Peters.

Synonymy and references: *Hyla parvidens*: Peters (1875: 620); Boulenger (1882: 407); Lucas (1892: 61); Fletcher (1898: 672-3); Nieden (1923: 236); Loveridge (1935: 43).

Peters' original description (1875: 620) reads: *Hyla parvidens*, n. sp. Diese Art, welche durch die Körperform, granulirte Beschaffenheit des oberen Augenlids und des Körpers, sowie durch die geringe Entwicklung der Schwimmhäute grosse Ähnlichkeit mit *Hyla Ewingii* hat, unterscheidet sich durch das viel kleinere Trommelfell, dessen Durchmesser nur ein Drittel des Augendurchmessers erreicht, und die ausserordentlich schwach entwickelten Vomerzähne, welche jederseits einen Haufen an der inneren vorderen Seite der Choanen bilden, aber so schwach entwickelt sind, dass sie nur mit grosser Mühe wahrgenommen werden können. Die Farbe ist einfach lehmgelb; nur auf den Schenkeln finden sich einzelne kleine dunkle Pünktchen. Von dem Nasenloch geht eine schwarze Linie durch das Auge über das Trommelfell an der unteren Seite einer dicken Hautfalte bis zur Gegend über dem Schultergelenk. Eine starke drüsige längliche Anschwellung hinter dem Mundwinkel. Totallänge 0,033; Kopflänge 0,011; Kopfbreite 0,011; vordere Extr. 0,025; Hand mit 3. Finger 0,011; hint. Extr. 0,058; Fuss mit 4. Zehe 0,026. Eine Exemplar aus Australien (Port Philipp).

Locality Records: Port Phillip, V., type locality, vide Peters (1875: 620); 2 (M.C.Z. 9585-6) Botany Bay, N.S.W. (W. F. H. Rosenberg) 1924, vide Loveridge (1935: 43).

Discussion.—Fletcher (1898: 672) considered the status of *parvidens* at length. He notes that the species "was founded in 1874 on a single specimen from Port Phillip, but is still unknown to Victorian naturalists. Admittedly it differs from *H. ewingii* chiefly in respect of the smaller tympanum (one-third the diameter of the eye), and the slightly developed vomerine teeth. Since from the examination of only about 17 specimens Mr. Boulenger found it necessary to allow for a variation in the size of the tympanum of from 'one-half to two-thirds that of the eye', it seems to me that it need not be a matter for any surprise if, when a more representative series were examined, it should be found that this allowance was insufficient. As a matter of fact some of the Victorian and other specimens do seem to have a smaller tympanum than usual, about one-third that of the eye. One such specimen is of especial interest, inasmuch as the vomerine teeth are normal on one side, but absent on the other. Of two other Victorian specimens one (half-grown) appears to have the vomerine teeth not perceptibly developed; the other has them on one side strongly developed, on the other only slightly." Fletcher then gives other instances of variation and abnormalities in vomerine elevations, and concludes "*H. parvidens* . . . may well have been only a light-coloured specimen of *H. ewingii* without definite bands or streaks, with imperfectly developed vomerine teeth, and with a smaller tympanum than usual; and if so the name *H. parvidens* would become an absolute synonym of *H. ewingii*". Peters in his original description notes the closeness to *ewingii* and relies chiefly on the small sizes of the tympanum and vomerine elevations to separate *parvidens*. Peters' variations all fall within the range of characters exhibited by the large series of *ewingii* examined by the present author. Lucas (1892: 61) observes that he has not seen *parvidens*. Loveridge's two specimens (1935: 43) appear to be covered by Fletcher's comments, and it would seem strange that *parvidens* should not be found again in Victoria but turn up 600 miles away at Sydney. Taken all in all it is practically certain that *parvidens* should be sunk in the synonymy of *ewingii*. This course has not been followed because of uncertainty concerning the form about Port Phillip.

HYLA INGUINALIS Ahl.

Ahl's original description (1935: 252) reads: Unter dem Material des Zoologischen Museums Berlin fand sich die nachstehend beschriebene Laubfroschart der Gattung *Hyla* vor, die ich mit keiner der bisher beschriebenen Arten identifizieren konnte. *Hyla inguinalis* spec. nov. Vomerzähne in zwei queren oder etwas nach hinten

konvergierenden Gruppen zwischen den Choanen; Zunge annähernd oval, hinten schwach eingeschnitten und frei abhebbar; Kopf mässig gross, so lang wie breit oder etwas breiter als lang; Schnauze mehr oder weniger spitz, im Profil schräg nach hinten abgestutzt, über das Maul vorspringend, länger als das Auge, wenig kürzer als der Abstand der vorderen Augenwinkel voneinander, länger als hoch; Canthus rostralis gerade, scharf; Lorealgegend steil, konkav; Nasenloch wenig aufgetrieben, näher der Schnauzenspitze als dem Auge; Internasalarraum kleiner als der Interorbitalraum, der etwas breiter als ein oberes Augenlid ist; Trommelfell deutlich, $3/5-2/3$ mal so breit wie das Auge, um die Hälfte seines Durchmessers von diesem entfernt. Finger nur mit einem Rudiment von Schwimmhaut; Halftscheiben etwa $\frac{3}{4}$ so breit wie das Trommelfell; 1. Finger kürzer als der 2., der kürzer als der 4. ist, der von dem 3. weit überragt wird; kein deutliches Pollexrudiment; Subarticulartuberkel deutlich. Zehen mit etwa $2/3$ Schwimmhaut, die an allen Zehen das letzte ganze oder das letzte halbe Glied, an der 4. Zehe die beiden letzten oder $1\frac{1}{2}$ letzten Glieder frei lässt; 3. Zehe etwas länger als die 5.; laterale Metatarsalia fest verbunden; Halftscheiben etwas kleiner als die der Finger; eine Tarsalfalte vorhanden; medialer Metatarsaltuberkel flach, oval, lateraler klein, rundlich; Subarticulartuberkel mässig. Bei nach vorn gestrecktem Hinterbein reicht das Tibiotarsalgelenk bis zum Vorderrand oder der Mitte des Auges; Femur etwas kürzer als die Tibia, die 4-5 mal so lang wie breit, 2 mal in der Körperlänge enthalten und länger als der Fuss ist; bei rechtwinklig angeknickten Hinterbeinen decken die Fersen einander. Haut oben glatt oder mit einigen verstreuten, kleinen Höckern; Kehle fein, Bauch und Unterseite der Oberschenkel grob gekörnelt; keine Querfalte auf der Brust vorhanden. Färbung (in Alkohol) sehr variabel, meist braun oder grau in verschiedenen Abtönungen, einfarbig oder dunkel gefleckt oder marmoriert; ein dunkler Streifen zieht vom Nasenloch durch das Auge bis zum Ansatz des Oberarmes; unter ihm verläuft ein weisser oder rötlicher Streifen vom Auge zum Mundwinkel. Hinterseite der Oberschenkel weiss mit einigen grossen, runden, schwarzen Flecken; Weichen mit einem oder mehreren grossen, schwarzen Flecken auf hellem Grunde. Totallänge 37 mm. Fundort: Südaustralien (wahrscheinlich Umgebung von Adelaide). Hier beschrieben nach 6 Stücken. Fundort: Südaustralien, Adelaide ?; Sammler Zietz. Die Art ist am nächsten verwandt mit *Hyla jeudii* Werner aus Neuguinea, unterscheidet sich aber wohl von dieser durch kürzere Schnauze, schmalere Interorbitalraum, grössere Haftscheiben, andere Färbung und andere Merkmale.

Discussion.—*Inguinalis* agrees fairly well with both *jervisiensis* and *calliscelis*. From the former it is separated by the heel only reaching to the centre of the eye and the presence of a few large black markings both on the back of the thighs and the flank. It is very close to *calliscelis*, but appears to have a larger tympanum, a wider interorbital space, and to lack the wide dark dorsal band from between the eyes to the back of the body. It is hoped to discuss this form later in relation to both *jervisiensis* and *calliscelis*.

HYLA JERVISIENSIS Duméril and Bibron.

Synonymy and references: *Hyla jervisiensis*: Duméril and Bibron (1841: 580); Günther (1858: 113); Krefft (1864: 389); Keferstein (1868b: 282); Boulenger (1882: 383); Werner (1897: 216); Fletcher (1890: 668, 670, 675; 1892: 11; 1894: 527, 530); Nieden (1923: 234); Loveridge (1935: 44); Scott (1942: 5-6, 10-11); MacKay (1955: 161). *Litoria jervisiensis*: Peters (1873: 612).

Duméril and Bibron's original description (1841: 580) reads: La Rainette de Jervis. *Hyla jervisiensis*. Nobis. Caractères. Tête courte, épaisse, ses côtés se rapprochant en angle sub-aigu, arrondi au sommet. Deux groupes de dents vomériennes, situés entre les arrière-narines, au niveau de leur bord antérieur. Parties supérieures d'un gris blanchâtre. Description. Cette espèce reproduit exactement le même ensemble de formes que la Rainette bleue, dont elle ne diffère que par les caractères suivants. Les dents vomériennes, au lieu de former une rangée transversale, assez généralement à peine interrompue au milieu, et située au niveau du bord postérieur des arrière-narines, sont distribuées en deux groupes très-écartés, placés sur la ligne qui conduit de l'angle antéro-interne d'une arrière-narine à l'autre. L'espace inter-nasal n'est pas creusé en

gouttière; les yeux, bien qu'assez gros, ne font pas de saillie au-dessus du crâne, qui est parfaitement plan. Il existe, de plus que chez la Rainette bleue, un petit cordon glanduleux en arrière de l'angle de la bouche. Coloration. Le canthus rostralis est marqué d'une raie brune; une bande de la même couleur s'étend longitudinalement sur la région tympanique. Toutes les parties supérieures offrent une teinte d'un gris blanchâtre; toutes les inférieures sont blanches. Dimensions. Tête. Long. 1" 5". Tronc. Long. 3" 2". Membr. antér. Long. 2" 8". Membr. postér. Long. 6" 1". Patrie. Ce Batracien provient du voyage de Péron et de Lesueur aux terres australes. La baie de Jervis est le lieu de la Nouvelle-Hollande où il a été recueilli par ces zélés naturalistes.

Description of R.10045a, an adult male, Yarramalong Mountain, near Gosford, N.S.W., Oct., 1929 (Wright and Barnes):

Habitus very slender with long limbs, but has a broad head sloping back to a narrow waist; total length of head and body 42 mm.; head blunt and obtusely rounded, broader than long (15 to 13 mm.); snout very short (5.5 mm.), equals diameter of eye, in a flattened curve when seen from above, almost vertical in profile, extending hardly at all beyond lower lip; canthus rostralis angular, short, almost straight, distinct; lores distinctly concave; interorbital width rather greater than that of an upper eyelid (4.25 to 3.75 mm.), narrow top of head flattish with eye bulges very large and distinct; internasal space 3.75 mm.; diameter of the eye 1.8 times its distance from nostril; tympanum round, distinct, directed slightly upward, contained in diameter of eye 1.8 times (3 to 5.5 mm.), distance from eye 1.25 mm., a rounded supratympanic ridge.

Skin smooth above, a few very small pits behind the head; chin minutely granular; throat and belly coarsely granular; posterior surfaces of thighs more finely so; limbs otherwise smooth; no pectoral fold; a small glandular fold behind angle of jaws; anal flap very small.

Forelimb moderately robust but long (32 mm.), 76% of length of head and body; finger discs small, rounded, considerably smaller than tympanum (2 to 3 mm.); hand 13 mm.; fingers in order of length, 1, 2, 4, 3; extent of webbing between fingers about 10% in all cases, but the web may be interpreted as merely a continuation of the narrow proximal fringes of the fingers; subarticular tubercles distinct, rounded; palm with three large tubercles; thumb with a large elongated tubercle on the inner side of the rather swollen base, a black horny patch on the inner and dorsal edge.

Hindlimb long and slender (73 mm.), 174% of head and body; femur 20 mm., tibia 23 mm., foot 30 mm.; heel reaches just beyond tip of snout; toe discs small and rounded, half diameter of tympanum (1.5 to 3 mm.); toes in order of length, 1, 2, 3 = 5, 4; extent of webbing between toes, 39, 49, 65 and 58%, outer toe webbed almost to disc; all toes with narrow fringes; subarticular tubercles prominent and rounded, distal large, proximal smaller; sole with two or three rounded tubercles; small metatarsal tubercles.

Vomerine elevations paired, of moderate size but prominent, transverse, well separated, the space between them equal to the width of one of them, each equal in size to one of the choanae which are oblique, situated on a line joining the anterior edges of the choanae, from which they are distinctly separated; tongue subcircular, grooved above, free and barely indented behind, about half width of mouth at angle of jaws; no external vocal sac.

Dorsal colour a uniform creamy grey; a few very small dark brown flecks, which are more pronounced on the limbs; a dark brown stripe along canthus rostralis and the supratympanic ridge; a white line anteriorly below this from nostril; it runs under the eye and tympanum to above the shoulder, and strongly picks out the glandular fold behind the mouth; sides with scattered brown spots, small but a little larger than those of the back; chin, throat and belly uniform light yellow; posterior and ventral surfaces of thighs a deeper clear yellow without any spots.

Specimens examined and Locality Records: 1 (R.2406, A.M.) Lawson, Blue Mts., N.S.W. (E. G. W. Palmer), Nov., 1898; 3- (R.5006-S, A.M.) Blackheath, Blue Mts., N.S.W. (E. C. Ross), Dec., 1910; 3 (R.6509, A.M.) Wilde's Meadow, Moss Vale, N.S.W. (Thos. Steel), Dec., 1913; 4 (R.8461, A.M.) Leura, N.S.W. (Thos. Steel), Nov., 1924;

3 (R.10045, A.M.) Yarramalong Mt., nr. Gosford, N.S.W. (Wright and Barnes), Oct., 1929; 6 (R.10973, A.M.) Launceston, Tas.; 1 (R.14444, A.M.) Flinders Island, Bass Strait (R. D. MacKay), 19-20.iii.1955.

Variation.—Only the three Yarramalong specimens which were found together are treated here. Both R.10045 *b* and *c* are much the same as R.10045*a* in habitus and general characters, but they are fairly deep brown instead of grey with a distinct band extending from between the eyes half way along the body and then breaking up into obscure dark mottling. The posterior surfaces of the thighs are plain light brown. The vomerine elevations are a little smaller and almost totally between the choanae. The white line under the eye to above the shoulder is very conspicuous. There is a trace of a dark band between the eyes.

Discussion.—Fletcher had six references to this species. He says that he visited Jervis Bay twice but failed to find 'that extremely rare frog *Hyla jervisiensis*. Though described by Duméril and Bibron . . . the species is, I believe, still known only from the type specimen obtained during the voyage of Péron and Lesueur'. Krefft had an interesting note (1864: 389) on *jervisiensis* "common near Sydney, in deep rocky places between ferns". Scott (1942) gave notes on the history of the species in Tasmania and added a key. MacKay collected three females on Flinders Island, Bass Strait, and remarks (1955: 161) that the hinder thigh colour was bright yellow and the largest specimen measured 35 mm. Loveridge (1935: 44) gives good reasons for including both *Hyla krefftii* and *calliscelis* in the synonymy of *jervisiensis*, and he may prove to be correct. Undoubtedly *calliscelis*, *inguinalis* and *jervisiensis* are very closely allied. Specimens from Tasmania, South Australia and the intervening islands should give the answer to the problem. Until there are adequate collections available the present author thinks it wise to suspend judgement. Loveridge's two-page discussion should be consulted. In the meantime the Yarramalong specimens are unquestionably *jervisiensis*, being larger, with body and head wider and more depressed and the habitus more elongated than the more compact *ewingii*.

HYLA ADELAISENSIS Gray.

Synonymy and references: *Hyla adelaidensis*: Gray (1841: 447); Günther (1858: 113; 1867: 56); Gegenbaur (1865) vide Keferstein (1868*b*: 278); Krefft (1865: 18; 1866: 33); Keferstein (1868*b*: 278); Fletcher (1890: 674; 1898: 672, 674, 681-2, 684); Andersson (1913: 23); Fry (1914: 209); Werner (1914: 422); Nieden (1923: 227); Kinghorn (1924: 181); Loveridge (1935: 48); Glauert (1945: 379; 1947: 48); Main (1954*a*: 118; 1954*b*: 170); Mitchell (1955: 405). *Hyla binoculata*: Gray (1841: 447); Fletcher (1898: 674). *Hyla schuettei*: Keferstein (1868*a*: 279).

Gray's original description (1841: 447) reads: *Hyla Adelaidensis*, Gray, t.8.f.2. Slender; fore-toes quite free, hinder toes webbed to the last joint; (in spirits) gray-blue, with a series of small oblong tubercles; the sides purple-brown with a white streak from the under side of the eyes to the shoulders; sides of the belly and region of the vent purplish, with small white spots; the hinder side of the thighs purple-brown, with three large oblong white spots; belly and under side of thighs granular; chin white, brownish dotted; palatine teeth in two roundish groups between the internal nostrils. inhab. Western Australia.

Description of No. 7281 in the Australian Museum, an adult female, King George Sound, Western Australia:

Habitus slender, width of body (14 mm.) 30% of total length of head and body (47 mm.); head pointed, elongated, pentagonal, longer than broad (16 × 13 mm.); snout rather long (7 mm.), 1.4 times diameter of eye (5 mm.), obtusely pointed when seen from above, rounded in profile, noticeably projecting beyond lower lip; canthus rostralis angular, straight and long; lores flattish but slightly concave, sloping upwards and inwards but not much from the vertical; interorbital width distinctly greater than that of an upper eyelid (4.5 to 3 mm.), top of the head shallowly concave between prominent eye bulges; internasal space 4.5 mm.; diameter of the eye slightly but noticeably longer than its distance from nostril; tympanum sharply distinct, almost

vertical, contained in diameter of eye 1.7 times (3 to 5 mm.), distance from eye 1.75 mm.; a low but distinct supratympanic fold bending down steeply behind tympanum to shoulder.

Skin smooth above; chin and throat smooth; belly and underside of thighs with a small area of posterior surface up to vent coarsely granulate; limbs otherwise smooth; a distinct thin pectoral fold; anal flap very small.

Forelimb moderately robust and long (22 mm.), 47% of length of head and body; hand 11 mm.; finger discs small, roughly rounded but a little longer than wide, half size of tympanum (1.5 to 3 mm.); fingers in order of length, 1, 2, 4, 3; the webbing between the fingers may be described as negligible or barely discernible except that between the 2nd and 3rd, where it is very evident and amounts to 18%; fingers fringed but very narrowly; subarticular tubercles small, rounded, distinct; palm granular; thumb with a fairly prominent elongated tubercle on preaxial side probably used for digging.

Hindlimb moderately robust and long, length (74 mm.) 157% of head and body; femur 20 mm., tibia 24 mm., foot 30 mm.; heel reaches to nostril; toe discs quite small, oval, contained nearly twice and a half times in tympanum (1.25 to 3 mm.); toes in order of length, 1, 2, 3, 5, 4, 3rd and 5th subequal; extent of webbing between toes, 63, 69, 71 and 67%; fringes extremely narrow; subarticular tubercles small, rounded, distinct; sole fairly smooth with one or two small tubercles; inner metatarsal tubercle large, elongated and projecting, no outer tubercle.

Vomerine elevations paired, large, roundish, transverse, distinctly separated, widely separated from the small choanae, situated between choanae, projecting very slightly in front of a line joining the anterior margins of the choanae, about bisected by a line joining the posterior margins; tongue oval, slightly nicked and free behind, a little more than half the width of mouth at angle of jaws.

Dorsal colour light brown with patches of dark brown which are irregularly arranged in broken longitudinal lines, one vertebral and the others dorsolateral; a dark brown band beginning on the tip of snout, becomes prominent between nostril and eye and grows wider behind the eye to include whole of tympanum, it then runs along side to groin; a white line gathers along the upper lip to become uniform under the eye, whence it runs backwards very distinctly under the tympanum and over the shoulder to break up half-way along the side into two or three dozen white spots which contrast sharply with their background—the dark brown band just described; ventral surfaces light brown becoming more yellow on belly; posterior surfaces of thighs chocolate-brown with a few odd white spots proximally.

Specimens examined and Locality Records: 2 (R.5105-6, A.M.) Western Australia (W.A. Museum). Jan., 1911; 2 (R.5301-2, A.M.) Albany, W.A. (A. Abjornssen), 2.i.1911; 8 (R.7584-5, A.M.) Perth, W.A. (J. J. Fletcher), Feb., 1922; 2 (R.7738-9, A.M.) Mississippi Bay, W.A. 26 m. E. of Esperance (Troughton, Grant, Hull and Wright), Feb., 1922; 2 (R.10967, A.M.) Manjimup, W.A. (M.C.Zool.), 1933; 2 (R.10976, A.M.) Peel Estate, S. of Perth, W.A. (M.C.Zool.), 1933; 2 (R.13768, A.M.) Spectacle Swamp, 30 m. S.W. of Perth, W.A. (Q. Vic. Mus., Launceston); 69 (7194, 7196-7203, 7205-12, 7218-22, 7224, 7226-29, 7232-45, 7250-64, 7267, 7269-74, 7276, 7280-82, 7284-5, A.M.) Western Australia, mostly from King George Sound; 4 (R.7213-6, A.M.) South Australia (no other data); 1 (R.70, W.M.) Harvey, W.A.; 23 (R.224-42, R.244-7, W.M.) Mammoth Cave, W.A.; 1 (R.256, W.M.) Balladonia, W.A.; 1 (R.306, W.M.) Pallinup River, W.A.; 4 (R.317-20, W.M.) Perth, W.A.; 15 (R.976-85, R.2740-1, R.2753-4, R.2761, W.M.) Osborne Park, W.A.; 1 (R.2279, W.M.) Como, W.A.; 1 (R.2421, W.M.) Tambellup, W.A.; 2 (R.2892-3, W.M.) Bunbury, W.A.; 2 (R.4662-3, W.M.) Lake Clifton, W.A.; 4 (R.6217-8, R.6240-1, W.M.) Manjimup, W.A.; 1 (R.6780, W.M.) Scaddan, W.A.; 3 (R.8465-7, W.M.) Gin Gin, W.A.; 1 (R.8682, W.M.) no data; 1 (R.11016, W.M.) Pt. Peron, W.A.; Port Essington, N.T., vide Günther (1858: 113; 1867: 56); Monger's Lake, Herdsman's Lake, Boyanup, York and Albany, all in W.A., vide Werner (1914: 422); Helena Gorge, near Mundaring Weir, W.A., vide Main (1954b: 170); 7 (U.S.N.M.128720-5, R.3252, S.M.) Oenpelli, N.T., vide Mitchell (1955: 405); wetter parts of the south-west . . . collected as far east as

Pine Hill (between Balladonia and Israelite Bay), vide Main (1954a: 118); 89 specimens from Claremont, Spectacle Swamp, Manjimup, Rockingham, Mt. Melville, Swan View, Darling Range, Margaret River, Pemberton and Perth, all in W.A., vide Loveridge (1935: 48).

All 154 A.M. and W.M. specimens, except R.256, have been examined.

Variation.—In a very few cases the diameter of the eye equals its distance from the nostril. In all 153 specimens examined the snout projects beyond the lower lip and is often acutely pointed in profile. The nostril is nearly always above or in advance of the lower lip, but in 7199 and 7267 the snout is almost vertical in profile and the nostril well behind the lower lip. The supratympanic fold is always present but varies much in size. Most specimens have a few, scattered, small, low warts dorsally, but they are rarely conspicuous. In R.306 and R.2741 the warts scattered over the back are small but very distinct. Twenty-six frogs have the chin and throat finely granulate to varying degrees. The belly and underside of thighs are always very coarsely granulate. The finger discs are frequently more than a half and as much as two-thirds the diameter of the tympanum. Webbing is always present between the 2nd and 3rd fingers, but it is sometimes a mere rudiment. Most individuals examined were probably males, but vocal sacs were generally difficult to see because of lengthy hardening in preservative. The sac has openings into the mouth on each side of the tongue, and external rucking or one median longitudinal fold extending to or almost to the pectoral fold which forms its posterior border. The heel averages to just in front of the snout, but sometimes reaches well in front of it. In 41 cases the vomerine elevations are entirely in advance of a line joining the posterior margins of the choanae. In the remainder they are about bisected by or are less than half behind this line. Fletcher's eight specimens from Perth, R.7584-5, have very robust elevations. An odd specimen has them slightly elongated and oblique, and in 7197 (total length 37 mm.) they are practically unnoticeable. The King George Sound specimens vary a great deal in their dorsal colour, which may be uniform light or dark brown but blackish markings are generally present. There may be as few as one distinct spot or there may be extensive mottling and marbling. Whenever there is much dark pigment there is at least a tendency to form a three-fold pattern of one median and two dorsolateral lines. The lines may be continuous or partly continuous and the remainder broken up into patches either anteriorly or posteriorly in any combination. 7205 is unique with an irregular tapestry pattern; the median brown markings on a light cream ground colour have a black border. The heavy black line from nostril to the side and the wide pure white line from upper lip to above the shoulder are always present. The white line usually starts under the eye but may occasionally be very wide and prominent from the snout to the eye. Odd specimens have the white line persisting behind the shoulder and then breaking up into many white spots. 7220 is unusual in having a second conspicuous, wide, white line above the eye and then well up on the side nearly to the groin. This line is also plain in R.242, and is barely suggested in about nine other specimens. The posterior surfaces of the thighs, except for the triangular granular area up to the vent, are very variable. They may be uniformly brown or dusted with white, or there may be from one to dozens of prominent separate white dots; again there may be a few very large more or less confluent white spots. Juveniles develop the typical pattern early.

Discussion.—This frog with its elongate, pointed snout, which gives it a shark-like profile, is typically a western form, but the question of its extension of range affords problems. The action of Boulenger and Andersson in including *schuettei* in the synonymy seems amply justified on Keferstein's original description and figure, but this raises a puzzle in distribution. Keferstein's type came from Sydney and it is almost certain that the species occurs nowhere near that city. However, the specimen may quite easily have been only sent from there by Dr. R. Schuette. The importance of exact locality records was not appreciated at the time and it is probable that friends who knew the doctor's interest in collecting frogs would bring him specimens from various places. There is no specimen of *adelaidensis* from the south-east corner of Australia in any of the six main Australian museums. Excluding *schuettei*, moreover,

there seems to be only one reference, that of Krefft (1866: 33) who says "*Hyla adelaidensis*. Adelaide Tree Frog. This species is not common on the Murray; its range extends as far as Western Australia". I feel reasonably sure, however, that *adelaidensis* does not occur in the south-east but must keep an open mind. Günther (1858: 113) records 14 specimens from Port Essington which were presented by Dr. Fleming. Glauert (1947: 48) pointed out the necessity for accuracy in locality records and denied Dr. Fleming's and the British Museum's Port Essington records of four typically south-west Australian frogs. Glauert's comments cannot be included here but should be consulted. It must be noted that Mitchell (1955: 405) records seven *adelaidensis* from Oenpelli in the Northern Territory. Fletcher handled only frogs from south-west Australia. Although he notes Krefft's Murray River reference earlier, he says (1898: 684) "as far as present knowledge goes Port Essington appears to be the eastern limit of *Hyla adelaidensis*". Boulenger's comprehensive description (1882: 408) is practically followed by Nieden (1923: 227). Andersson (1913: 23) gives a carefully detailed account of the colour and pattern of his five frogs from Perth and notes their closeness to *schuettei*. Werner (1914: 422) deals with the coloration of nine specimens from five localities. Loveridge (1935: 48) who had 89 specimens discussed diagnosis and colour pattern in life, and says "In coloration (after preservation in alcohol) the blue gray backs of the young (taken in grass on the edge of a swamp at Manjimup) are reminiscent of preserved examples of *Hyla bicolor* but may be distinguished by their elongate and more acuminate snouts". Main (1954a: 118) gives notes on distribution, colour and habitat "reed-grown margins of swamps and lakes". Gray's *binocularata* (*bioculata*) described on the same page as his *adelaidensis* is obviously identical with it. Gray divided his species into three varieties based mainly on the spotting on the posterior surfaces of the thighs, but these all fall within the range of *adelaidensis* as shown above under the heading of variation.

HYLA AUREA AUREA (Lesson).

Synonymy and references: *Rana aurea*: Lesson (1830, 60). *Hyla aurea*: Günther (1858: 114); Girard (1858: 48); Krefft (1864: 388; 1865: 18); Steindachner (1867: 61); Kieferstein (1868b: 284); Boulenger (1882: 410); Fletcher (1889: 358-9, 365, 368-72, 381-2, 384-5; 1890: 667, 670-3, 675; 1891: 264; 1892: 8, 12; 1894: 525-6, 530); Chisholm (1925: 62); Briggs (1934); Parker (1938: 302); Loveridge (1935: 49; 1950: 134); Moore (1954: 65). *Ranoidea jacksoniensis* (*Hyla jacksoniensis*, Bibron MS.): Tschudi (1838: 76). *Hyla jacksoniensis*: Duméril and Bibron (1841: 602). *Hyla* (*Auletris*) *jacksoniensis*: Fitzinger (1843: 30). *Ranoidea resplendens*: Girard (1853: 422; 1858: 48). *Ranoidea flavoviridis*: Girard (1853: 422). *Ranoidea aurea*: Girard (1858: 48). *Auletris jacksoniensis*: Fitzinger (1860: 413). *Litoria aurea*: Günther (1864: 49). *Fanchonia elegans*: Werner (1893: 82; 1897: 266).

Lesson's original description (1830: 60) reads: Grenouille Bande-D'Or. *Rana aurea*, Less. (Pl. VII, fig. 2, g.n.) White, dans sa Voyage à la Nouvelle-Galles du Sud, a donné une figure d'une grenouille de la Nouvelle-Hollande (pl. et pag. 248) sous le nom de blue frog. Mais sa description est si incomplète et sa figure est si médiocre, que nous ignorons quelles sont ses analogies avec l'espèce que nous figurons. Cette grenouille épaisse et régulièrement proportionnée, est longue de 2 pouces et demi. Ses yeux sont gros et saillants. Son museau arrondi, court et obtus. Ses membres antérieurs sont terminés par 4 doigts légèrement arrondis à leur sommet, et les cinq doigts des pieds également globuleux à leur phalange dernière sont proportionnés et largement palmés. Le corps est lourd, un peu ventru. La bouche ample et très-fendue. Les cuisses épaisses et charnues. Elles sont longues de 14 lignes, les jambes ont aussi 14 lignes, et les tarses, le grand doigt compris, ont 19 lignes. La peau du corps est lisse, unie, celle du ventre rugueuse chagrinée, tandis que celle de la gorge est lisse. Le dessus du corps et les membres sont bleu-céleste clair, le dessous et le dedans des membres sont blanc bleuâtre. Ce qui distingue cette belle espèce, est une bande d'or très-scintillante qui naît sur le rebord orbitaire, suit longitudinalement les côtés du corps, et s'arrête au point de départ des cuisses. Un oeil simulé par un point noir cerclé d'or occupe le dessus de la commissure de la bouche, non loin et derrière l'oeil

véritable. Une bandelette dorée contourne le bord de la mâchoire supérieure, et dépasse l'angle de la bouche. Les doigts et les pieds sont blanchâtres. Nous observâmes cette grenouille dans la rivière Macquarie à Bathurst, au-delà des montagnes Bleues. Elle y est abondante.

Description of A.C.338, an adult male, Razorback Mountain, near Picton, N.S.W., 8.v.1939:

Habitus, a sturdy but not especially thick-set species, width of body (34 mm.) 43% of total length of head and body (80 mm.); head smoothly and obtusely pointed, a little longer than broad (28 × 26 mm.); snout rather long (13 mm.), nearly twice diameter of eye (7 mm.), rounded when seen from above and in profile, extending well in front of lower lip; canthus rostralis distinct, straight and angular; lores decidedly concave, receding at a low angle from rounded upper jaw; interorbital width equals that of an upper eyelid or may be the merest fraction more (5.5 mm.), the narrow top of the head is flattish between the extremely prominent eye bulges; internasal space 5 mm.; diameter of the eye equals its distance from nostril; tympanum very distinct, round, set obliquely, contained in diameter of eye about 1.1 times (6 to 7 mm.), distance from eye 2 mm.; supratympanic fold very conspicuous, it starts behind the eye and divides just behind the tympanum, one part bending down to end above shoulder and the other continuing straight along the side.

Skin smooth or very finely roughened dorsally; belly with ventral and most of posterior surfaces of thighs coarsely granulate; more finely granulate under forelimbs and throat; ventral margin of lower jaw smooth; sides coarsely granulate, less so posteriorly; upper eyelids and triangular area behind tympanum rough; limbs dorsally and all of hindlimb below knee smooth; a rather inconspicuous pectoral fold; a very small anal flap.

Forelimb robust and fairly long (50 mm.), 63% of length of head and body; hand 23 mm.; finger discs well developed, slightly longer than wide, about half diameter of tympanum (3 to 6 mm.); fingers in order of length, 1, 2, 4, 3; the rudimentary webbing is practically little more than the junction of the distinct fringes except that between thumb and 2nd finger, where it is somewhat more prominent; subarticular tubercles large and prominent; palm with two large elongated tubercles; thumb with a large pad and with a prominent elongated preaxial tubercle.

Hindlimb long and robust, length (131 mm.) 164% of head and body; femur 34 mm., tibia 40 mm., foot 57 mm.; heel reaches to about nostril; toe discs distinct, rounded, about equal in size to those of fingers (3 mm.); toes in order of length, 1, 2, 3 = 5, 4; extent of webbing between toes, 76, 80, 71 and 75%, the strong granular web reaches to the discs of the 1st and 5th and postaxial side of 4th; toes distinctly fringed; subarticular tubercles distinct, flattened; sole granular; large oval inner metatarsal tubercle, no outer tubercle.

Vomerine elevations paired, strongly developed and projecting, well separated from each other but close to choanae, each bearing six or seven minute acicular teeth, about transverse, perhaps very slightly oblique convergent posteriorly, no part in advance of choanae, about bisected by line joining posterior borders of choanae, which are moderate in size; tongue suboval, free and feebly indented behind, nearly as wide as mouth at angle of jaws; a rather large subgular vocal sac with its posterior margin forming most of the pectoral fold and with a large opening into the mouth at each side of the tongue.

Colour above bluish in alcohol; yellowish-white below; sides with a good deal of the same colour; a very plain white line from eye over the tympanum follows a distinct dorsolateral fold along the body to the groin; another distinct short white line from under tympanum to above shoulder.

Specimens examined and Locality Records: 8 (A.C. 165-172) Razorback Mt., near Picton, N.S.W., 16.x.1938; 4 (A.C. 336-9) Razorback Mt., N.S.W., 8.v.1939; 3 (A.C. 350-2) Bundanoon, N.S.W., 21.v.1939; 1 (A.C. 413) Tallong, N.S.W., 22.v.1939; 1 (A.C. 1364) Fitzroy Falls, N.S.W., 8.x.1941; 1 (A.C. 4531) Barrengarry Mt., N.S.W., 5.xii.1949; last two localities east of Moss Vale; 1 (A.C. 5051) Waverley, Sydney, N.S.W., 15.x.1953;

10 (R.4194-6, R.4198-4203, R.4205, A.M.) Maroubra, N.S.W. (Fry and Ross), 26.ix.1908; 1 (R.4251, A.M.) Warrell Creek, Nambucca River, N.S.W. (D. Fry), Oct., 1908; 1 (R.4452, A.M.) Sans Souci, Botany Bay, N.S.W. (H. Wright), 6.v.1909; 4 (R.4665-8, A.M.) Woonona, near Bulli, N.S.W. (H. L. Coleman), Feb., 1910; 2 (R.5388-9, A.M.) North Sydney, N.S.W. (S. J. Johnston), Oct., 1911; 1 (R.5849, A.M.) Cook's River, Sydney, N.S.W. (A. Musgrave), Aug., 1912; 2 (R.5893-4, A.M.) Nambucca River, N.S.W. (H. E. Smart), Sept., 1912; 1 (R.6324, A.M.) Gurravembi, Nambucca R., N.S.W. (Fry and Smart), Oct., 1913; 1 (R.6664, A.M.) Noumea, New Caledonia (Roux, Basel Mus.), 15.v.1914; 1 (R.7325, A.M.) Capertee, N.S.W. (J. J. Fletcher), Nov., 1921; 1 (R.7376, A.M.) Burrawang, N.S.W. (J. J. Fletcher), Nov., 1921; 2 (R.7446-7, A.M.) Pambula, N.S.W. (J. J. Fletcher), Feb., 1922; 1 (R.7527, A.M.) Lower Clarence River, N.S.W. (J. J. Fletcher), Feb., 1922; 1 (R.7974, A.M.) Upper Colo, via Richmond, N.S.W. (Kinghorn, Fletcher and Wright), Oct., 1922; 1 (R.8256, A.M.) Botany Bay, N.S.W. (F. A. McNeill), 19.xii.1923; 3 (R.8454, R.8456, R.8483, A.M.) Sydney, N.S.W. (T. Steel), Nov., 1924; 3 (R.9424, R.9426-7, A.M.) Wentworthville, N.S.W. (J. F. King), Jan., 1928; 1 (R.9532, A.M.) Botany, N.S.W. (Boy Scouts), Oct., 1928; 1 (R.9558, A.M.) Five Dock Quarry, Sydney, N.S.W. (F. Hawks), Oct., 1928; 1 (R.12075, A.M.) Botanic Gardens, Rotorua, New Zealand (J. C. Wiburd), 11.iii.1937; 5 (R.14529, A.M.) East Lakes, Sydney, N.S.W. (J. Moore), 17.x.1952.

All 63 specimens listed have been examined.

Variation.—It has been found impossible to exclude a good deal of information about *a. raniformis* while discussing *a. aurea*, and the details given here have not usually been repeated. With the few qualifications below all 58 adult frogs of the central eastern *a. aurea* subspecies agree in having no vertebral line from snout to vent and in having a quite smooth or practically smooth dorsum, at most with a very few scattered low warts. A white line follows the dorsolateral fold, which is continuous or nearly so, from the upper eyelid to groin. There is a shorter white line from the upper jaw to over forearm; and a black line along the canthus rostralis which may run well along the side under the white dorsolateral line. The posterior surfaces of the thighs are usually plain bluish over light yellowish-brown. One of the four Woonona frogs is exceptional in having a trace of a light median stripe along the posterior half of the body although the others are normal. R.6664 from New Caledonia shows traces of the dorsal colour pattern and other characters of typical *a. aurea*, but the dorsolateral stripe and fold die out before the groin. However, this is matched in the Woonona and a few other frogs. R.5388, but not R.5399, has a few low but rather large warts scattered over the posterior half of the dorsum. The vivid green markings of life are often preserved as a bold reticulation in light and dark. In R.4202 and R.8456 it survives in a beautifully reticulated pattern. Ventral surfaces are immaculate yellow or white. Forty specimens have the typical large, well separated, transverse vomerine elevations. Eighteen, including two Maroubra, three Bundanoon and four Razorback Mountain individuals, have small rounded elevations, which are usually totally between the choanae but in one case behind them. Three Maroubra and one Woonona frog have them oblique. In four or five cases the elevations can hardly be termed separated and this may have bearing on the status of *a. ulongae*. Measurements of a large series of *a. aurea* showed that the length of the inner metatarsal tubercle was contained on the average in its distance from the tip of the inner toe exactly three times. This was very little different from the 2.9 times of an even larger series of *a. raniformis*. The head is slightly longer than wide in 75% of cases, equal in the rest. Combined femur and tibia measurements are somewhat variable. The heel falls short of the snout in about 65%. In half the remainder it reaches just to the tip, and in the rest it extends beyond. Length of the hindlimb to that of the head and body averages 170%. *Aurea* seems to be a larger race than *raniformis*. Of 19 specimens in the author's collection snout-vent measurements exceed 60 mm. six times (32%) and of these four are more than 70 mm. (21%), i.e. 60, 65, 74, 77 and 80 (twice). In a much larger series of *raniformis* (93) 60 mm. is exceeded the same number of times (6%), but 70 mm. only once (1%), i.e.

60, 61 (twice), 64, 65 and 71 mm. In both races males have a black, horny nuptial plate on the thumb. R.9558 is unusual in having two extra limbs, while R.9532 has three practically perfect left forelimbs.

Discussion.—This the nominate race occurs commonly in the central eastern areas of New South Wales—about Sydney and extending over the Dividing Range to Bathurst, which is the type locality, and nearby places about the headwaters of the Macquarie River. Its range also includes the southern tablelands at least as far as Tallong, and a narrow coastal strip 800 miles long almost reaching the Queensland and Victorian borders. There is an island of *a. ulongae* in the Dorrigo district in the north; and to the south the coastal Pambula population is only separated by a few miles from the upland Bombala *a. raniformis*. References to *aurea* have been sorted out as well as possible, but one cannot know definitely in some cases what race is referred to. *Aurea aurea* is characterized by its practically smooth dorsum and lack of a white vertebral stripe among other details which are dealt with fully under variation of both *a. aurea* and *a. raniformis*. Lesson's original description (1830: 60) of his frogs, which he found abundant on the Macquarie River at Bathurst, clearly applies to this race. He notes that the skin above was uniformly smooth, and in his fairly detailed account of the coloration makes no mention of a vertebral white line. Fletcher gives more than 20 references. He describes breeding habits and other behaviour (1889: 384). His records from Guntawang and Cullenbone, near Mudgee, are almost certainly of *a. aurea* for Mudgee is only about 60 miles from Bathurst. Numerous early authors are listed in the synonymy. Classification of the races of *aurea* was confused until Parker (1938: 302) separated off the Western Australian *Hyla cyclophynchus* and divided eastern forms into *a. aurea* and *a. raniformis*. The latter still included Western Australian frogs as well as those from Victoria and Tasmania. Parker was handicapped by lack of material. He says that no specimens had been examined from south western New South Wales. Moore (1954: 65) proved that the Western Australian form known as *Hyla aurea* was distinct from the Sydney one by crossing experiments. However, he retained the name *Hyla aurea raniformis* (Parker) for both the Western Australian and Victorian frogs. *A. aurea* has been introduced into both New Zealand and New Caledonia. Krefft (1864, 1865) remarks that *aurea* appears to live in the water exclusively, and notes its service as food for the natives and *Pseudechis*, and in turn the frog's own omnivorous appetite. He also gives information on range, habitat, habits, colour and voice. Briggs (1934) in his text-book gives the only complete morphological and anatomical account, of which I am aware, of any Australian frog.

HYLA AUREA RANIFORMIS (Keferstein).

Synonymy and references: *Chiroidryas raniformis*: Keferstein (1868a: 358). *Hyla aurea*: Krefft (1866: 33); Keferstein (1868b: 284); McCoy (1867: 182; 1885: 13); Boulenger (1882: 410); Fletcher (1889: 358; 1890: 674-5; 1891: 272; 1894: 530); Lucas (1892: 61; 1896: 47); Spencer (1892: 21); Waite (1929: 258); Fleay (1935: 122); Loveridge (1949: 214). *Ranhyla aurea*: McCoy (1867: 182). *Ranoidea aurea*: McCoy (1885: 13). *Hyla aurea raniformis*: Parker (1938: 302); Loveridge (1950: 134).

Keferstein's original description, which includes that of his new genus (1868a: 358) reads: *Chiroidryas*, gen. n. Gaumenzähne vorhanden, Zunge breit, Trommelfell gross, am oberen Rande von einer niedrigen aber langen Parotis überragt. Finger frei, Daumen stark entgegengesetzbar, Zehen mit grosser schwimmhaut; Endplatten deutlich, aber nicht sehr gross. Rücken mit zerstreuten grossen Höckern. Schmale Parietalfontanelle, grosses und verknöchertes Ethmoidale, welches die vorderen Stirnbeine oben weit auseinanderdrängt. Clavicula und Coracoideum von fast gleicher Stärke, schmale Epicoracoidbogen, grosses zweizipfliges Xiphosternum, grosses Knorpeliges Episternum. Querfortsätze des Sacralairbels stark verbreitert. Diese Gattung unterscheidet sich von *Pelodryas* ausser durch den sehr abweichenden mehr Rana-artigen Habitus durch die kleinen Endscheiben der Finger und Zehen, durch die höckrige Rückenhaut und durch die schmale Parietalfontanelle. *Chiroidryas raniformis* sp. n. Gaumenzähne in zwei etwas nach hinten convergirenden, länglichen von vorderen

Rande der Choanen beginnenden Gruppen. Zunge breit, hinten etwas ausgeschnitten. Canthus rostralis stumpf, Schnauze unten nach vorn vorgezogen. Hinter dem Mundwinkel eine stark vorspringende Fettmasse. Zehen mit dreiviertel Schwimmhäuten, am Metatarsus ein Hautsaum und unten ein spitzer Höcker. Der ganze Rücken mit zerstreuten grossen Tuberkeln, die Unterseite mit kleinen, dichtgedrängten Warzen, zwischen den Armen eine Hautfalte über der Brust. Rücken bräunlich mit heller Rückenlinie und hellen Marmorierungen, am Canthus rostralis ein dunkler auf der Parotis ein heller Streif.—Körper 82 mm., Beine 116 mm. lang. Australian (ein Exemplar).

Specimens examined and Locality Records: 1 (A.C.4833) Tocumwal, N.S.W. (I. M. Watts), 1.xi.1951; 9 (A.C.5648-56) 18 m. W. of Bairnsdale, V., 28.xii.1955; 24 (A.C.5747-70) Gol Gol, lower Murray River, N.S.W., 11.i.1956; 16 (A.C.5785-5800) Darlington Point, Murrumbidgee River, N.S.W., 13.i.1956; 9 (A.C.5826-34) Balranald, Murrumbidgee River, N.S.W., 12.i.1956; 3 (A.C.5858-60) 10 m. W. of Narrandera, Murrumbidgee River, N.S.W., 14.i.1956; 6 (A.C.5861-6) 8 m. S. of Bombala, N.S.W., 26.xii.1955; 11 (A.C.5919-21, 5924, 5927, 5929-30, 5933-4, 5943, 5946) Fryingpan Creek, 1 m. S. of Adaminaby, N.S.W., 23.xii.1955; 1 (A.C.5978) 13 m. S.E. of Horsham, V., 3.i.1956; 13 (A.C.6006-18) Bacchus Marsh, V., 1.i.1956; 1 (R.5233, A.M.) Berridale, Monaro Dist., N.S.W. (E. L. Troughton), Feb., 1911; 4 (R.5959-62, A.M.) Naracoorte, S.A. (E. A. Briggs), Nov., 1912; 1 (R.6683, A.M.) Naracoorte, S.A. (A. M. Sharpley), June, 1914; 1 (R.7344, A.M.) Emu Plains, near Narrandera, N.S.W. (J. J. Fletcher), Nov., 1921; 1 (R.8421, A.M.) Mt. Horeb, Tumut Dist., N.S.W. (J. H. Wright), Sept., 1924; 5 (R.9480-4, A.M.) Koonadan, Leeton, N.S.W. (McKeown and Kinghorn), 1928-9; 1 (R.9644, A.M.) Tumut, N.S.W. (T. V. Sherrin), 15.xi.1928; 8 (R.10661-8, A.M.) Yanco, Murrumbidgee area, N.S.W. (Kinghorn, McKeown and Barnes), Oct., 1932; 21 (R.10669-89, A.M.) Tubbo Station, Riverina, N.S.W. (K., M., and B.), Oct., 1932; 2 (D.3276-7, N.M.) Mordialloc and Brighton, V.; 2 (D.5529-30, N.M.) Darwin, N.T.; 1 (D.7974, N.M.) Cobungra, V. (A. Burns), 24.ii.1947; 2 (D.7989-90, N.M.) Macedon, V. (D. G. Hoffman), 10.x.1948; 1 (R.2809, S.M.) Taillem Bend, S.A. (H. Johnston), 24.iii.1947.

All 144 A.M., N.M., S.M., and A.C. specimens have been examined.

Variation.—This race normally differs from *a. aurea* in having a distinct white vertebral line from snout to vent and in having the back warty, especially from behind the head to the end of body. The dorsum may be extremely warty, generally without pattern, but the warts may be arranged roughly in four or six longitudinal rows. The distinct white line from nostril to groin following the dorsolateral fold may be quite wide. The fold is often broken up posteriorly into a series of disconnected tubercles or it may even die out. Ventral surfaces are usually immaculate white. The posterior surface of the thigh is normally divided into a lower narrow, light, plain brown area and an upper area heavily marked with white as spots or patches on brown. About 43% of the frogs examined strictly belong to this typical class. They include 15 of the 16 Darlington Point individuals, 10 of the 24 Gol Gol, and seven of the nine Bairnsdale. A.C.5648 has a nearly smooth dorsum and A.C.5650 is ventrally much suffused with dark. Another 52% are nearly typical as the frogs above, but the vertebral line is only faint and there is usually a trace of dark on chin and throat. They clearly belong to *a. raniformis* and can easily be distinguished on the grounds of wartiness and other characters. This group includes the Balranald, Bombala, Tocumwal and Horsham frogs, 14 from Gol Gol, two from Bairnsdale, and one each from Narrandera and Darlington Point. The remaining frogs distributed over the whole geographical range have the vertebral line missing. Twenty-two specimens have the back of the thigh divided into a pale ventral band, above it a bluish band with a few white spots about the vent. In the large Riverina series in the Australian Museum individuals are often extremely warty with very wide and distinct median stripes and occasionally, as in R.10661, have black dendritic markings extending from the chin to well behind the forelimbs. Nearly every specimen has the vomerine elevations large, transverse and narrowly separated. In five frogs they are small, rounded and totally behind the choanae, in seven others small and almost totally behind. In

A.C.5653 the elevations are hardly separated. The webbing of the toes is slightly more developed than in *a. aurea*. The majority have the head as long as wide, but in 20 it is slightly longer and in 12 a little wider. The length of the snout to the diameter of the eye is equal at 1.73 in both *a. aurea* and *raniformis*, but frogs from southern Victoria may have the snout a trifle shorter. In the Bairnsdale specimens the ratio is 1.59 and those from Bacchus Marsh 1.53. The heel fell short of the snout in 62% of cases, to the tip in 13%, and slightly beyond in 25%. The length of the hindlimb to that of head and body averages 166% and does not depart more than 1% from this for groups of frogs taken separately. The 11 juveniles from Adaminaby with metamorphosing tails and all with snout-vent measurements about 16 mm. are interesting in that the dark pigment which later in adults becomes distributed in spots and patches over the back is concentrated in four longitudinal streaks. Two of these are large and half-way between the vertebral and dorsolateral positions. They extend for most of the posterior two-thirds of the body or from between the eyes to the end of the body. The two others are shorter, more posterior and high on the sides. There may be one or two smaller patches on each side. The white line below the eye and at least the beginnings of the dorsolateral one are clearly outlined.

Discussion.—Keferstein (1868a: 358) received his single type specimen from Sydney, but no doubt it was brought from the country, although the locality is not stated. The description does not apply to frogs living about Sydney with their smooth backs and absence of a vertebral line. Keferstein says that the whole back of his type was scattered with large warts and had a light vertebral line. Later (1868b: 285) he sank his *raniformis* in the synonymy of *Hyla aurea*, saying that he had examined more than 100 of that species and that *raniformis* was only an aged specimen. Here he was obviously dealing with a mixed series of *aurea aurea* and *aurea raniformis*, because he states that the backs are generally smooth and ascribes wartiness to advanced age. This is not so, because many small Murrumbidgee frogs are very warty while large Sydney ones are smooth. Keferstein's mention that there was sometimes a light stripe down the back is another proof that his large collection was composed of individuals of both races. He also gives a clear illustration (Plate 7, fig. 18) of the specimen he had previously described as *raniformis*. The figure shows the vertebral white line and dorsal wartiness very well. The figure with the two descriptions leaves no doubt that *raniformis* is the valid name for those frogs with their headquarters in the Murray system and that it cannot be applied to those of central eastern New South Wales. Nieden (1923: 223) also had the two eastern races and at least one, probably both, of the Western Australian species mixed in his description. Krefft (1866: 33) notes this subspecies as the "Common Golden Tree Frog, *Hyla aurea*" from the lower Murray and Darling, and says: "This species, widely distributed over Australia, is the most common of all our Batrachians; the natives when pinched for food capture large numbers of it by the light of a torch at night; a supply of this frog can always be secured wherever there is fresh water near." Lucas (1892: 61) records it from all parts of Victoria. I think Fletcher had at least five references to this race. McCoy writes (1867: 182): "The Batrachia, with the exception of the common green frog (*Ranhyla aurea*) are rarely seen or heard, the true tree-frogs (*Hyla*) inhabiting the lofty gum trees." In his Prodomus (1885: 13) he gives a very good description, especially of colour, and a long discussion on voice. Fleay (1935: 122) records *raniformis* swallowing small Tiger Snakes. Two frogs were photographed eating the same snake from opposite ends.

HYLA AUREA MAJOR, subsp. nov.

Synonymy and references: *Hyla aurea*: Boulenger (1882: 410); Fletcher (1898: 673); English (1910: 633); Lord and Scott (1924: 102); Scott (1942: 5, 10).

Type.—No. 1939.120, in the Queen Victoria Museum, Launceston, T., Collins Gap, T. (W. H. Boswell).

Description.—The specimen is very closely allied to *H. a. raniformis*. There is a very distinct white vertebral stripe. The vomerine elevations are robust, slightly

oblique, touch the line joining the anterior borders of the choanae and are about half behind the choanae. Each bears about six sharp, needle-like teeth, and are well separated. The dorsum is warty. Snout-vent measurement is 72 mm.

Specimens examined and Locality Records: 1 (R.6048, A.M.) Launceston, T. (Q.Vic.Mus.), Jan., 1913; 2 (1939.120, Q.V.M.) Collins Gap, T. (W. H. Boswell); 2 (1159, a and b, Q.V.M.) Launceston, T. (T. M. S. English), 1910; country drained by the North Esk, South Esk, Tamar and Mersey Rivers, vide English (1910: 633); Burine, Emu Bay, T., vide Fletcher (1898: 673).

Variation.—The small series examined show little variation. Sides are very warty, especially the continuation of the dorsal fold. R.6048 has the throat and other ventral surfaces immaculate light yellow.

Discussion.—The Tasmanian race is separated from *raniformis* almost solely on the grounds of larger size. Four Q.V.M. specimens measured 72, 62, 61 and 54 mm. Lord and Scott (1924: 102) give the body length as 80 mm. In large series of *raniformis* 60 mm. was only exceeded in about 6% of specimens, and 70 mm. only once (about 1%), and then only by 1 mm. (71 mm.). It must be noticed, however, that Keferstein gave the body length of his type of *raniformis* at 82 mm., which can only be regarded as very exceptional. Fletcher (1898: 673) records frogs collected at Burine, Emu Bay, remarking "three specimens with a light vertebral stripe, as is common in western examples". English (1910: 633) gives notes on distribution and habits. He says "a well marked specimen is most gorgeously coloured: green, gold, blue and white . . .". Lord and Scott remark on the frog's ability to change colour with extreme rapidity. Boulenger (1882: 410) records Tasmanian specimens collected by R. Gunn and Capt. Ross's Expedition.

HYLA AUREA ULONGAE Loveridge.

Synonymy and references: *Hyla aurea ulongae*: Loveridge (1950: 133); Moore (1954: 67).

Loveridge's original description (1950: 133) reads: *Hyla aurea ulongae*, subsp. nov. Type.—California Academy of Sciences No. 83,235, a male from Ulong, northeastern New South Wales. Collected by J. R. Slevin, January 28, 1948. Diagnosis.—This frog, uniformly plumbeous above, immaculate white below, is characterised by a single series of vomerine teeth between, and level with, the anterior borders of the choanae. Undoubtedly closely related to *aurea*, from which it may be distinguished as follows:

1. Length of inner metatarsal tubercle contained 3 to 3½ times in its distance from the tip of the inner toe 2
 Length of inner metatarsal tubercle contained 2 to 2½ times in its distance from the tip of the inner toe; dorsolateral fold indistinct or discontinuous; vertebral and dorsolateral light lines usually absent though sometimes indicated in the young 3
2. Dorsum with more or less strongly developed warts, rarely smooth; dorsolateral fold broken up into a chain of warts and not extending to the groin; a vertebral light line usually indicated; dorsolateral light lines frequently broad and discontinuous, being less sharply defined than in typical *aurea*; range: Northern Territory; Western Australia; Victoria; Tasmania *a. raniformis* (Keferstein)
 Dorsum almost or quite smooth; dorsolateral fold continues from eye to groin; no light vertebral line; a light line along the dorsolateral fold and another from beneath the eye to the shoulder; range: New South Wales (introduced into New Caledonia and New Hebrides) *a. aurea* (Lesson)
3. Dorsum smooth; entire underside, including axillae, groins, concealed surfaces of femora, tibia and tarsi, uniformly white; range: New South Wales ... *a. ulongensis*, subsp. nov.
 Dorsum warty; axillae, groins, concealed surfaces of femora, tibiae and tarsi, black with conspicuous, round, yellow spots; range: south Western Australia *a. cyclothynechus* (Boulenger)

Description.—Head slightly longer than broad; snout subacuminate, its length (to anterior corner of eye) slightly less than the distance separating the anterior corners of the eyes; nostril considerably nearer the end of the snout than it is to the anterior corner of the eye; canthus rostralis not very distinct; loreal region oblique, concave; interorbital space the width of an upper eyelid; diameter of tympanum two-thirds that

of the eye; tongue large, not or but slightly emarginate behind, slightly free; vomerine teeth strongly developed in a single, slightly curved series between, or anteriorly on a level with, the front of the choanae. Fingers free of web, first shorter than second, which is shorter than fourth, which is shorter than the third, disk of the third rather more than half the diameter of tympanum; toes well webbed, the web extending half-way between the distal tubercle and disk on the first, to the disk on the second, third, and fifth, to just beyond the second tubercle on the fourth toe; in other words the terminal joints free of web from first to fifth are $\frac{1}{2}$, 0, 0, 2, and 0; subarticular tubercles well developed; an oval inner, but no outer, metatarsal tubercle; tibio-tarsal articulation of the addressed hindlimb reaches the nostril. Skin above smooth; a curved supratympanic fold; forearm smooth, without dermal ridge or series of tubercles; being a male there is a partly pigmented nuptial swelling at base of first finger; no lappet on heel; a rather inconspicuous dermal ridge along outer edge of foot. Below, throat and breast smooth; belly and thighs granular. Colour.—Above, uniformly plumbeous. Below, immaculate white. Size.—Total length from snout to anus of holotype male, 49 mm., hindlimb 82 mm.

Specimen examined and Locality Record: 1 (R.13817, A.M.) Ulong, Dorrigo Dist., N.S.W. (J. R. Slevin) 28.i.1948.

Discussion.—The type which is now in the Australian Museum is the only specimen examined. Specimens of *a. aurae* from the Nambucca and Clarence Rivers differ from it. They have prominent white lines dorsolaterally and running along the upper jaw under the tympanum to the shoulder. Their vomerine elevations are also strongly developed and paired, and in addition R.5893-4 are slightly warty posteriorly. *Ulongae* may be an upland form and it seems wise on the grounds of its coloration and single vomerine series to retain it as a subspecies. Further collecting may straighten out the matter.

HYLA BLANDSUTTONI Procter.

Synonymy and references: *Hyla blandsuttoni*: Procter (1924: 1128); Loveridge (1935: 50).

Procter's original description (1924: 1128) reads: Description of a new species of *Hyla*. Among a small collection of live Reptiles and Batrachians from Australia, recently purchased by the Society, is a beautiful Tree-Frog of the genus *Hyla*, which belongs to a new species, which I propose to call *blandsuttoni* in honour of Sir John Bland-Sutton. *Hyla blandsuttoni*, sp. n. Description. Habit raniform. Head longer than broad; snout obtusely pointed, canthus rostralis distinct, loreal region very oblique, somewhat concave; nostril twice as far from eye as from tip of snout; interorbital space as wide as or a little narrower than the upper eyelid; tympanum distinct, oval, about $\frac{3}{4}$ the diameter of the eye. Fingers free, first slightly longer than second, and used as a thumb in life; * toes $\frac{3}{4}$ webbed, leaving two phalanges of fourth toe free; digital discs small, as in *H. arborea*, those of fingers and toes equal; subarticular tubercles moderately developed, a small oval inner metatarsal tubercle and a slight tarsal fold. Tibia $4\frac{1}{2}$ times as long as broad; tibio-tarsal articulation reaching the anterior corner of the eye when the hind limb is addressed. Skin finely granular above, coarsely so beneath, the parts of the legs which are usually concealed are, however, covered with very delicate smooth skin; a dorso-lateral glandular fold extending from the posterior corner of the eye almost to the groin; a second, indistinct and broken up on each side of the back. Coloration: iridescent bronze on all exposed upper surfaces, with a dark canthal streak which continues on the temporal region; throat white; abdomen and lower surfaces of thighs bronzy. All parts which are hidden when the Frog is at rest (i.e., axillae, flanks, groins, and "flash" portions of legs and feet) brilliant torquoise-blue, shading to sapphire in the axillae and groins. Iris metallic copper. The striking "flash" colours are, of course, only exhibited when the Frog is jumping or climbing, and will no doubt fade after death. In repose the general bronze effect is entirely inconspicuous.

* *Hyla aurea* also uses its 1st finger as an opposable thumb.

Affinities. Allied to *H. aurea*, from which it differs in the following particulars:

<i>H. aurea</i> .	<i>H. blandsuttoni</i> .
Canthus rostralis: rounded.	sharply marked.
Nostril: equidistant from eye and end of snout.	about twice as far from eye as from end of snout.
Fingers: moderate in length, first equal to second.	long, first longer than second.
Toes: entirely webbed, one phalanx of fourth free.	$\frac{3}{4}$ webbed, two phalanges of fourth free.
Discs: hardly developed, no wider than penultimate phalanges of digits.	small, but wider than penultimate phalanges, shaped as in <i>H. arborea</i> , not as in <i>H. rubella</i> .
Habit:	slenderer in build than <i>H. aurea</i> .

Habitat. Queensland. This must, however, be regarded as uncertain, because the frog was purchased, and the person from whom it was bought touched at a good many Australian ports, and as he did not leave an address it is not possible to verify the type-locality.

Type. The type-specimen is an adult female, at present living in the Reptile House. After death it will be presented to the British Museum (Natural History). A coloured plate of it is given, since when it is dead the whole of the characteristic and very beautiful "flash" colours will disappear.

Locality Records: 1 (M.C.Z.3525) Sydney, N.S.W. (T. Steel), 1914, vide Loveridge (1935: 50); Queensland ? (bought), type locality, vide Procter (1924: 1128).

Discussion.—I do not think that I have seen a specimen of this frog, the status of which is puzzling. Procter's six tabulated points of difference from *H. aurea* may be dealt with separately. The canthus rostralis in *H. a. aurea* is rather variable ranging from smoothly rounded to quite angular. No specimen examined had the nostril twice as far from the eye as from the end of the snout but some approached this ratio. The 1st and 2nd fingers are constantly equal in length, but when the 2nd is rotated towards the 1st it may appear shorter. Only one phalanx of the 4th toe may be described as free, not two as for *blandsuttoni*. Finger discs of *a. aurea* are always considerably wider than the penultimate phalanges, but are sometimes only slightly so in *a. raniformis*. In habit *a. aurea* may range between stout adults and quite slim small and sub-adults. Procter's description is accompanied by a plate which shows her frog in a "climbing attitude". The animal is slim and the colours are sharply contrasted. She says of the living frog "iridescent bronze on all exposed upper surfaces". Most living *a. aurea* have the dorsal gold or bronze handsomely mottled with green but there are odd specimens in which the green is suppressed. The type locality being given as Queensland, although with uncertainty, adds another problem because *aurea* is not known from that State. Loveridge identified a Sydney frog M.C.Z.3525, collected by T. Steel at Sydney, as *blandsuttoni*. He says (1935: 50) "the canthus is not so strongly marked as in her living type, however, but it possesses the dorso-lateral glandular fold which is characteristic of *aurea*. It differs from our Sydney specimen of *aurea* in the rounded, somewhat transverse, groups of vomerine teeth; in its more slender toes and smaller, though more distinct, disks; and in the absence of an outer metatarsal tubercle. Some faintly vein-like dark mottling is present on the back". There is a tendency in *a. aurea* for the vomerine elevations to be variable and a large proportion have them small and rounded. The outer metatarsal tubercle is missing and as noted above much variation in the size of the discs. There may be heavy dark mottling or even reticulation. More than 20 frogs from near Sydney, some collected by Steel, have been examined and are typical *H. a. aurea*. Taken all in all it seems certain that *blandsuttoni* is a synonym of

H. a. aurea, but it has been thought advisable to retain the species because of the remote chance that the type locality may be correct and that *blandsuttoni* may be rediscovered in Queensland.

HYLA MOOREI, sp. nov.

Synonymy and references: *Hyla aurea*: Gray in Grey (1841: 436); Boulenger, part (1882: 410); Fletcher (1898: 681-2); Werner, part (1914: 422); Kinghorn (1924: 181; 1933: 127); Loveridge (1935: 49); Glauert (1945: 379). *Hyla aurea raniformis* (non Keferstein): Parker (1938: 302); Loveridge (1950: 134); Main (1954: 119); Moore (1954: 65).

Description of R.5981 in the Western Australian Museum, an adult male, from Pemberton, W.A.:

Habitus rather robust; length of head and body 75 mm.; head slightly pointed, about as long as broad (27 × 26 mm.); snout short (13 mm.), 1.6 times diameter of eye, about equal to distance between anterior corners of orbits, bluntly pointed when seen from above, rounded in profile, slightly overhanging lower lip; canthus rostralis short, low and rounded; lores concave, sloping at a low angle from the rounded upper jaw; interorbital width equal to that of an upper eyelid (6 mm.), the top of the head concave between prominent eye bulges; internasal space 5 mm.; diameter of the eye rather more than its distance from nostril; tympanum very distinct, round, tilted slightly upwards, contained in diameter of eye 1.3 times (6 to 8 mm.), distance from eye 4 mm.; a well-defined supratympanic fold from eye bending downwards to just behind forelimb.

Skin of head and body, except for upper jaw, shagreened and with two phases of warts. The larger warts are numerous and very roughly arranged in longitudinal rows. This is most noticeable in the two rows which begin in advance of the eyes and run back on each side of the vertebral line to near the vent. The smaller warts, which average about a quarter the size of the larger, are plentifully sprinkled between them. Thigh and to lesser extent tibia warty above. Forelimbs and tarsus smooth. Sides more or less uniformly warty. Chin and throat granulate except for margin of lower jaw. Belly and thighs, including wide triangular area up to vent, coarsely granular. Otherwise ventral surfaces of limbs smooth. A tarsal fold and a low indistinct, dotted ridge behind forearm. A fold across breast and a low dorsolateral one. A very small anal flap.

Forelimb robust and of moderate length (49 mm.), 65% of length of head and body; hand 23 mm.; finger discs rather small but distinct, rounded, half size of tympanum (3 to 6 mm.); fingers in order of length, 1, 2, 4, 3; webs rudimentary being little more than the union of the narrow fringes; subarticular tubercles distinct and rounded; palm warty; thumb with a prominent tubercle and large warty pad.

Hindlimb strong and long; length (130 mm.) 173% of head and body; femur 34 mm., tibia 39 mm., foot 57 mm.; heel reaches nearly to snout; toe discs very much the same shape and size of those of the fingers; toes in order of length, 1, 2, 3=5, 4; extent of webbing between toes, 60, 70, 80 and 78%; 1st, 2nd and 3rd toes webbed to discs on postaxial and 5th on preaxial sides; remainder of toes distinctly fringed; subarticular tubercles rather low and rounded, but distinct; sole with low granulation; inner metatarsal tubercle large and elongated, no outer one.

Vomerine elevations paired, widely separated from each other but close to choanae which are small, robust, slightly oblique, between choanae, but also a trifle before and well behind because of the small size of the openings; tongue subcircular, free and feebly indented behind, as wide as mouth; a rather small subgular vocal sac with an opening into the mouth on each side of the tongue.

Dorsal surfaces uniformly olive or greenish-blue in alcohol, except for a middorsal light line from between eyes to vent; ventral surfaces yellowish, nearly uniform but for obscure dark reticulation which is only visible in certain lights; posterior surfaces of thighs bluish as dorsum but with granular area up to vent lighter; tympana brown.

Specimens examined and Locality Records: 24 (R.2347-57, A.M.) Perth, W.A. (H. Richards), 4.ix.1898; 2 (R.4953-4, A.M.) Coolgardie, W.A. (W.A. Mus.), 1910; 4 (R.5297-5300, A.M.) Albany, W.A. (A. Abjornssen), 2.vi.1911; 1 (R.7476, A.M.)

Donnybrook, W.A. (J. J. Fletcher), 1.ii.1922; 1 (R.7531, A.M.) Newcastle, W.A. (J. J. Fletcher), 1.ii.1922; 7 (R.7576-7, R.7579-83, A.M.) Perth, W.A. (J. J. Fletcher), 1.ii.1922; 1 (R.7696, A.M.) Tudor, W.A. (Troughton and Wright), 3.ii.1922; 6 (R.7698, R.7703, R.7743-5, R.7699, A.M.) Albany, W.A. (Troughton, Grant, Wright and Hull), 1921-2; 1 (R.10463, A.M.) S-W. Aust. (J. R. Kinghorn), 4.viii.1931; 1 (7132, A.M.) W.A. (W. J. Stephens); 4 (7144, 7156-7, 7187, A.M.) King George Sound, W.A. (G. Masters); 1 (R.119, W.M.) Subiaco, W.A.; 2 (R.301-2, W.M.) Denmark, W.A.; 2 (R.529-30, W.M.) East Perth, W.A.; 1 (R.627, W.M.) Perth, W.A.; 3 (R.1152-3, R.2749, W.M.) Tambellup, W.A.; 1 (R.1178, W.M.) Midland Junction, W.A.; 4 (R.1210-3, W.M.) Lake Yanchep, W.A.; 12 (R.2025-7, R.6268-76, W.M.) Rottnest, W.A.; 1 (R.3739, W.M.) Mt. Lawley, W.A.; 1 (R.3800, W.M.) Elleker, W.A.; 1 (R.4585, W.M.) Karridale, W.A.; 1 (R.4664, W.M.) Lake Clifton, W.A.; 4 (R.5980-1, R.8539-40, W.M.) Pemberton, W.A.; 1 (R.8404, W.M.) Bridgetown, W.A.; 1 (R.8462, W.M.) Gin Gin, W.A.; 1 (R.9459, W.M.) no data; 5 (R.10953, A.M.) Perth, W.A. (M.C.Z.), 2.ix.1933; 1 (R.11537, A.M.) Tambellup, W.A. (F. R. Bradshaw), 6.iii.1935; Balcatta Beach, Causeway, Claremont, near Perth, Munger Lake, Swan View, Spectacle Swamp, Manjimup, Pemberton, Augusta, Rottnest Id., Wallcliffe, Merredin, all 13 localities in W.A., vide Loveridge (1935: 49).

All 95 A.M. and W.M. specimens have been examined.

Variation.—The vomerine elevations are very regular although a few may be a little smaller or larger than usual. Most specimens resemble R.5981 in having rather large warts arranged in irregular longitudinal rows. They generally begin between and a little in advance of the eyes and are most pronounced on each side of the vertebral line. Smaller warts are scattered among the larger. Only one specimen is quite smooth, but 18 are only slightly warty. Eight frogs are extremely warty. The back is bluish in alcohol. The vertebral light stripe is often quite faint, but very clear in some specimens particularly those from Perth and Albany. It is absent in only seven of 95 frogs. R.2357, A.M., consisting of 14 metamorphosing juveniles with tails of varying length all show the white median stripe clearly. Ventral surfaces are nearly always yellowish or dirty white. Five individuals have a not very pronounced darkening about the chin and throat extending back to about the forelimbs. A Perth frog with a very distinct vertebral line is dark brown ventrally with white spots anteriorly but no reticulation. The groins and both anterior and posterior surfaces of the thighs are uniform drab greyish or brownish blue without spots, except for about five individuals. One had a few dark blotches behind the thigh, another black stippling, while three had obscure light spots.

Discussion.—This species is unique among Australian *Hylas* in that it was established on genetic instead of the usual morphological grounds. Moore (1954: 65) separated the Western Australian frogs as a distinct species on the basis of genetic isolation as proved by crossing an eastern *Hyla aurea aurea* female from Burradoo, N.S.W., with western males from Pemberton, W.A. The embryos were abnormal and failed to develop beyond about 13 days. Moore's paper should be consulted for details and for the evolutionary implications which cannot be given here. He summarizes his finding as "These results indicate that the New South Wales individuals belong to a different species from those in West Australia, a conclusion that would never be reached with the usual methods of taxonomy". Moore considered that the Western Australian form should be called *Hyla raniformis* (Parker), but *raniformis* of Keferstein must be retained for the southern subspecies of *aurea* as shown under the present discussion of *Hyla aurea raniformis*. This leaves the western species without a name. I have carefully considered the possibility of using Werner's *elegans*. He described *Fanchonia elegans* (1893: 82) from a specimen found in a jar with African specimens and accordingly described it as probably from tropical Africa. Later (1897: 266) he notes "*Fanchonia elegans*—*Hyla aurea* Less. (defectes und deformiertes Exemplar)". His original description does not appear to tally with the western form. The name must be regarded as unavailable. It was decided to name the species for Professor John A. Moore, Department of Zoology of Barnard College and Columbia University, New York, whose stay as Fulbright Research Scholar at the University of Sydney did so much to

stimulate interest in Australian frogs. The separation of *raniformis* from *moorei* also establishes a clear cut genetic gap. Parker (1938: 302) and Moore both considered that *raniformis* occurred on both sides of the gap separating the eastern and western populations. This was unsatisfactory because *raniformis* is clearly a race of *aurea*. There is now shown to be two Western Australian species *moorei* and *cyclorhynchus* and one eastern species *aurea* divided into *a. aurea*, *a. raniformis*, and *a. ulongae*. This form has consistently been known as *Hyla aurea* until Parker's analysis when it was altered to *H. a. raniformis*. Werner (1914: 422) had a mixed collection of about 40 *cyclorhynchus* and *moorei* from 15 localities. He discussed the smoothness, wartiness, the light vertebral stripe, colouring and other characters of his specimens. Werner does not mention his *elegans* so his large series of Western Australian frogs did not suggest its identity with them. Main (1954: 119) says of this species "The coastal and wetter parts of the South-west in the same general situations as *H. adelaidensis*. Somewhere east of Cheyne Beach and west of Jarraamongup this species is replaced by *H. cyclorhynchus*." He discusses its coloration and habitat. Parker (1938: 302) gives a clear discussion of the whole *aurea* problem and classifies *moorei* under *Hyla aurea raniformis*. Loveridge (1935: 49) records it from 13 localities in Western Australia. He discusses relationship with *cyclorhynchus* and notes that females have the larger discs. His largest specimen from Wallcliffe measured 86 mm. Later (1950: 135) he distinguishes his Western Australian material as *H. a. raniformis*. *Moorei* may be separated from *raniformis* by larger size, more or less shagreened skin, normally two phases of warts, and in being more warty generally. Wartiness alone serves to distinguish 80% of specimens; only one *moorei* in 95 was smooth. Rabb and Mosimann (1956: 388) note that Moore's paper has been cited as a basis for general arguments, and then discuss his conclusions and make certain criticisms. Moore (1956: 390) gives a detailed reply. Both letters are of considerable interest to anyone concerned with dynamic aspects of Australian herpetology.

HYLA CYCLORHYNCHUS Boulenger.

Synonymy and references: *Litoria aurea*, var.: Günther (1870: 402). *Hyla aurea* var. *cyclorhynchus*: Boulenger (1882: 410); Kinghorn (1924: 181); Loveridge (1935: 49; 1950: 134). *Hyla cyclorhynchus*: Parker (1938: 302); Glauert (1945: 379); Main (1954: 119). *Hyla cyclorhyncha*: Whitley (1947: 49).

Boulenger's original description (1882: 411) directly follows his description of *Hyla aurea* and reads: Var. *cyclorhynchus*. *Litoria aurea*, var., Günth. Proc. Zool. Soc. 1870, p. 402, pl. 30.f.3. Snout shorter, more rounded. Groin and sides of thighs black, with white spots; lower surfaces densely reticulated with black, these being, however, immaculate in the young specimen. Perhaps a species. Five specimens, male, female and young. W. Australia. G. Krefft, Esq. (P.).

Description of R.7176 in the Western Australian Museum, an adult female, from Scaddan, W.A.:

Habitus moderately slender; total length of head and body 71 mm.; head almost semicircular, as wide as long (24 mm.); snout markedly short (10 mm.), one and a third times diameter of eye (7.5 mm.), smoothly rounded when seen from above, projecting in profile, extending well beyond lower lip; canthus rostralis distinct although low; lores distinctly concave, receding at a low angle from rounded upper jaw, which is turned to form a broad ledge below; interorbital width equal to that of an upper eyelid (5 mm.), flattish part of head narrow between prominent eye bulges; internasal space 5 mm.; diameter of the eye greater than its distance from nostril; tympanum very distinct, set obliquely, contained in diameter of eye about 1.25 times (6 to 7.5 mm.), distance from eye nearly 3 mm.; a low supratympanic fold.

Skin smooth above; finely pitted or roughened posteriorly and on the limbs; chin and throat with low granules; smooth laterally; belly and underside of thighs with a small triangular area up to vent coarsely granulate; otherwise undersides of limbs smooth; a low fold across breast; a very small anal flap.

Forelimb robust and moderately long (42 mm.), 60% of length of head and body; hand 20 mm.; finger discs moderate, rounded, 0.4 times diameter of tympanum (2.5 to 6 mm.); fingers in order of length, 1, 2, 4, 3; fingers free of web and fringing except for merest rudiment between thumb and 2nd finger; subarticular tubercles large, rounded and prominent; palm rough; a large elongated tubercle at the base of the thumb and another postaxial one the same size.

Hindlimb long and powerful, length (99 mm.) 140% of head and body; femur 26 mm., tibia 32 mm., foot 41 mm.; heel reaches to tympanum; toe discs distinct, rounded, smaller than those of fingers, one third diameter of tympanum (2 mm.); toes in order of length, 1, 2, 3=5, 4; extent of webbing between toes, 46, 64, 73 and 76%; toes fringed to discs; subarticular tubercles prominent, rounded but rather flattened; sole with low supernumerary tubercles in lines; an indistinct tarsal fold; inner metatarsal tubercle large, distal end somewhat free; no outer tubercle but two low warts in line with median toe.

Vomerine elevations paired, large, slightly oblique, well separated from each other and from the choanae which are a little smaller, mainly between the choanae but projecting a little before and behind, each elevation bears from three to five small acicular teeth; tongue subcircular, free and slightly indented behind, nearly width of mouth.

Dorsal surfaces greyish with a greenish tinge, heavily islanded with black, mainly longitudinally elongated patches about twice as long as wide, but these are often even more elongated or on the other hand reduced to a round spot, two of the dark markings are sometimes confluent; much black speckling on the side of head and on limbs; groin and forepart of thigh black with large white or yellow spots; posterior surfaces of thighs blackish with many smaller white spots, except for narrow yellowish triangular area up to vent; all ventral surfaces yellowish heavily reticulated with black, except the chin and throat which are black dotted; tympana brown.

Specimens examined and Locality Records: 3 (R.815-7, W.M.) Monigup Pass, Stirling Ranges, W.A.; 7 (R.2140-6, W.M.) Jacketup, via Gnowangerup, W.A.; 6 (R.2538-43, W.M.) Railway Dam, Ongerup, W.A.; 35 (R.6609-12, 7146, 7148-61, 7163-7, 7169-79, W.M.) Scaddan, W.A.; 15 (R.7130-44, 7168, W.M.) almost certainly of Scaddan series above; 5 (R.8671-5, W.M.) Esperance, W.A.; 1 (R.8778, W.M.) Como, W.A.; 1 (R.10050, W.M.) Mornington Mills, W.A.; 1 (R.10115, W.M.) Mondrain Island, W.A.; 3 (R.10536, 10538-9, W.M.) Phillips River, W.A., 14.v.1952; 1 (R.7736, A.M.) Mondrain Id., Recherche Arch., W.A. (Troughton, Wright, Grant and Hull), Feb., 1922; 1 (R.7737, A.M.) Lucky Bay, E. of Recherche Arch., W.A. (T., W., G., and H.), Feb., 1922; 3 (R.9888-9, R.11537, A.M.) Tambellup, W.A. (F. R. Bradshaw), 1929-1935; 12 (7045-7, 7137, 7159-66, 7169-70, A.M.) W.A.; 4 (7146, 7183-4, 7186, A.M.) King George Sound, W.A. (G. Masters); 5 (M.C.Z.18100-4) Merredin, W.A., vide Loveridge (1935: 49 and 1950: 135); Pine Hill and Hopetoun, both W.A., vide Main (1954: 119).

Variation.—The snout is always rounded with the distance between its tip and the anterior corner of the eye less than that between the anterior corners of the eyes. Specimens having large rather flat warts arranged in roughly longitudinal series, which usually outline a narrow, smooth vertebral area, amount to about 30%; another 36% are about the same order of wartiness but the warts are more scattered; about 13% are extremely warty both on the back and part of the sides. Of 98 specimens 10 were almost smooth with only odd warts. Only nine were quite smooth. Vomerine elevations were very stable being well separated, practically transverse and between the choanae in all cases except six. In three the elevations were oblique, in two small, while in R.8671 the left half was normal but the right was almost absent. Dorsal surfaces are usually grey with dark irregular rounded islands. Two Scaddan and the Lucky Bay frogs have the dark markings in two bands running back from the eyes to half-way down the body and forming between them a light vertebral stripe. The chin and throat are generally heavily, but sometimes more lightly, speckled or stippled with black. Ventral surfaces, except in juveniles where they are uniform white, are heavily reticulated with black on a yellow or yellowish ground. Two Scaddan

frogs have almost uniform brown bellies, but are reticulated from chin to just behind the forelimbs. Practically every specimen has the groins and the anterior surfaces of the thighs with large white or yellow spots in a reticulation of black, and the thighs behind black with smaller white spots except for a speckled area about the vent. An odd individual has the posterior surfaces of the thighs almost uniform black with a few very small white dots. On the other hand, as in the Jacketup frogs, there may be only a very few large spots.

Discussion.—The interesting genetic history of the development of *cyclorhynchus* with *moorei* from an early *aurea* stock can only be surmised. Günther (1870: 402) first realized that it was distinct. He summarized the colour position and noted that the very young specimens had the "lower parts white, entirely immaculate". His plate gives a very fine ventral view of a large individual. He says "a number of examples, received from tropical parts of Australia, of the north as well as west, belong to a very marked variety . . .", but Parker (1938: 302) who sorted out most of the *aurea* question and separated *cyclorhynchus* as a full species, said "there is no record in the British Museum of such data. The specimens were received in 1869 and 1870 from Dr. Krefft, and it is possible that they may have been part of the collection made by Masters in 1866 in W. Australia, and probably come from the neighbourhood of King George's Sound". Parker gives D. L. Serventy's colour notes of a frog in life. Kinghorn (1924: 181) discusses the colour of specimens from Mondrain Island and Lucky Bay. Whitley (1947: 49) says that *H. cyclorhyncha* with a tortoise and other freshwater animals of the Albany-Esperance region is "allied to Tasmanian forms". Main (1954: 119) in his key says "this form extends along the southern coast, and has been taken as far east as Pine Hill. As large as *H. aurea* and appears to differ from this species mainly in the black and sulphur markings in groin and on thigh. Dorsally has a pattern of green blotches, and lacks the mid-dorsal stripe usually found in *aurea*. Habitat swamps and permanent waters. At Hopetoun it is commonly found in rain water tanks". Loveridge (1950: 135) partly using the ratio of the length of the inner metatarsal tubercle to its distance from the tip of the inner toe treated *cyclorhynchus* as a race "instead of a full species as Parker has done and as its distribution may yet require".

HYLA X Moore.

Original description.—This is to be found in a forthcoming publication by J. A. Moore.

Description of No. A.C.3287, an adult male, Hampton, near Jenolan Caves, N.S.W., 7.iii.1947:

Habitus, a moderately robust species with long, strong limbs; total length of head and body 47 mm.; head bluntly rounded, as broad as long (17 mm.); snout short (7 mm.), 1.17 times diameter of eye (6 mm.), evenly and bluntly rounded when seen from above, slightly rounded but almost vertical in profile, extending very little beyond lower lip; canthus rostralis very short and angular; lores almost flat except for a concave pocket under canthus rostralis, receding upwards obliquely; interorbital width slightly greater than that of an upper eyelid (5 to 4.5 mm.), narrow top of head flattish between the large, prominent eye bulges; internasal space 4.75 mm.; diameter of the eye about 1.4 times its distance from nostril; tympanum rather small, distinct except for granular posterior border, nearly vertical, contained twice in diameter of eye (3 to 6 mm.), distance from eye 2 mm.; supratympanic fold from eye to above shoulder distinct but low.

Skin quite smooth above; chin and throat finely granular, belly and most of ventral and about half of posterior surfaces of thighs coarsely granular; remainder of limbs smooth; no pectoral fold; anal flap very small.

Forelimb robust and fairly long (36 mm.); 77% of length of head and body; hand 15 mm.; finger discs well developed, slightly wider than long, nearly size of tympanum in which they are contained 1.2 times (2.5 to 3 mm.); fingers in order of length, 1, 2, 4, 3, the 4th shorter than 3rd by length of disc; webbing almost absent except between 2nd and 3rd fingers, extent of webbing, 8, 15 and 11%; subarticular

tubercles prominent, large and rounded; palm with supernumerary tubercles and a large divided tubercle on the outer side; thumb with a large pad and a large black patch on the preaxial side.

Hindlimb strongly built and fairly long, length (82 mm.) 175% of head and body; femur 25 mm., tibia 24 mm., foot 33 mm.; heel reaches well in advance of snout; toe discs well developed, roundish, smaller than those of fingers, more than half diameter of tympanum (2 to 3 mm.); toes in order of length, 1, 2, 3 = 5, 4; extent of webbing between toes, 48, 53, 70 and 63%; web rather divided so that there are fringes on the inner side of the 5th and the opposing sides of the 2nd and 3rd, fringes on other toes very narrow; subarticular tubercles prominent, rounded; sole smooth; inner metatarsal tubercle large and in form of a prehallux, outer tubercle smaller but quite distinct, rounded, in rather central position in line with 4th toe.

Vomerine elevations large, paired, transverse, widely separated, abutting on choanae which are small, situated on a line joining the anterior corners of the choanae; tongue heart-shaped, free and feebly indented behind, large, slightly narrower than mouth at angle of jaws; no external vocal sac.

Colour above creamy-brown, flecked with points, patches and larger areas of dark brown to nearly half the whole dorsal surface; the largest dark patches are quite irregular but connect the eyelids and extend half-way down the back on each side of the midline; the front of the snout is dark brown; a narrow line of the same colour from nostril to eye, becoming very wide behind eye to include tympanum and supra-tympanic ridge, dies out above shoulder; obscure dark banding on hindlimbs; posterior surfaces of thighs light brown with a dark brown and light grey mottled patch below vent; yellowish-white below.

Specimens examined and Locality Records: 11 (R.3125-35, A.M.) Fish River, Tarana, N.S.W. (J. A. Thorpe), Nov., 1900; 2 (R.3198-9, A.M.) Tarana, N.S.W. (Wm. Hawken), June, 1901; 5 (R.4215-9, A.M.) The Valley, Katoomba, Blue Mts., N.S.W. (Dene Fry), Oct., 1908; 8 (R.5189-96, A.M.) Megalong Valley, Katoomba, Blue Mts., N.S.W. (D. B. Fry and H. L. Coleman), Feb., 1911; 1 (R.5261, A.M.) Baulkham Hills, near Sydney, N.S.W.; 15 (R.5929-43, A.M.) Penrose Farm, Macquarie River, 8 m. from Bathurst, N.S.W. (J. R. Kinghorn); 1 (R.6269, A.M.) Penrose Farm, near Bathurst (J. R. Kinghorn), Sept., 1913; 21 (R.6701-15, A.M.) Penrose Farm (J. R. Kinghorn), Sept., 1914; 8 (R.7457-62, A.M.) Kanimbla Valley, Blue Mts., N.S.W. (J. J. Fletcher), Feb., 1922; 5 (R.9224-5, R.9230, R.9233, R.9236, A.M.) Williams River, N.S.W. (Musgrave and Campbell), Jan., 1927; 1 (R.10963, A.M.) Salisbury, N.S.W., 1000 ft. (M.C.Z.), 1933; 8 (R.13378-81, A.M.) Cox's River, Bowenfels, N.S.W. (Kinghorn and MacKay), Feb., 1948; 1 (A.C.3287) Hampton, near Jenolan Caves, N.S.W., 7.iii.1947.

All 87 specimens listed have been examined.

Variation.—The head is normally slightly broader than long, and the snout well rounded in profile. Eye bulges are usually very prominent so that the upper eyelid encroaches on the interorbital space and is wider than it. The diameter of the eye is always greater than its distance from the nostril, often very markedly so. The tympanum is normally contained 2.5 times in the diameter of the eye. It is unusual for it to be contained as little as twice, as in A.C.3287, and occasionally it is only a third the diameter of the eye. The skin is smooth above, but there are a few scattered warts over the dorsum in most cases. These may become quite prominent on the head, between the eyes and for a little distance behind. R.4216 is decidedly warty all over. A low pectoral fold is nearly always present, or there may be merely a groove running between the forelimbs. Finger discs are distinct but not large; they usually measure about 75% the diameter of the tympanum but range from 67 to 100%. Webbing between the fingers is very slight, and in most cases the fingers can fairly be described as free. Toe discs are a little smaller than those of the fingers, but are quite distinct. The heel reaches to well in advance of the tip of the snout in nearly every case, but in odd specimens it only reaches as far as the tip. Webbing between the toes is very constant, agreeing with the standard description. The inner metatarsal tubercle is always elongated, distinct and rather large. The outer one is invariably present, but small, rounded and in line with the 4th toe. Subarticular tubercles of both hand

and foot are prominent. Vomerine elevations are practically completely between the choanae, except that the choanae are usually small and they then project behind. The elevations are normally well separated, but they may be close together and rather small, as in a large proportion of the Penrose Farm frogs. In R.4215, R.5930, R.5936, R.7460 and one of R.9225 they are contiguous; in R.6704, both R.6712, and one of R.13381 they are very small and rounded. Males have a dark nuptial shield, and the thumb is much swollen and at right angles. The largest specimen seen, R.6701, measured 51 mm. from snout to vent. Coloration is fairly constant, although the ground colour of the dorsum may be of various shades of cream, grey and brown, with the markings dark brown, dark grey or even blackish. An odd specimen has a uniform light dorsum flecked with small dots. The Penrose Farm series includes a few almost uniform light brown individuals, but the majority are most beautifully marmorated, reticulated and dotted on light creamy brown. The dark band between the upper eyelids is present in about half the specimens. Posterior surfaces of the thighs are most often light brown with obscure white patches or spots. The species does not have the black plate with insuliform light markings of *lesueurii* or the more or less bold black patterns on yellow of *peronii*. The posterior surfaces may be of an almost uniform light colour, or occasionally the more ventral half may be whitish or light brown and the more dorsal half darker.

Discussion.—The Australian Museum specimens are in two jars marked "an apparently undescribed *Hyla*. Ranges from Blue Mts. to Armidale at least. Will be described later . . . J. Moore". This highland species has been included here for the sake of completeness, but not named.

HYLA LESUEURII Duméril and Bibron.

Synonymy: *Hyla lesueurii*: Duméril and Bibron (1841: 595); Steindachner (1867: 60); Keferstein (1868b: 278); Boulenger (1882: 412); Fletcher (1889: 360, 371, 373, 385; 1890: 669-672; 1892: 8, 9, 12; 1894: 526, 528-531); Lucas (1892: 61; 1896: 47); Fry (1912: 100, 106); Andersson (1916: 15); Nieden (1923: 235); Procter (1923: 1071); Loveridge (1935: 51); Mitchell (1955: 404). *Hyla oculata*: J. E. Gray, Peron MS. in J. Grey (1841: 436). *Pelodytes affinis*: Gray (1842: 56). *Euscelis Lesueurii*: Fitzinger (1843: 31). *Litoria freycineti* (non Tschudi): Günther (1858: 97) vide Boulenger (1882: 413). *Euscelis Lessonii*: Fitzinger (1860: 413). *Litoria wilcoxii*: Günther (1864: 48; 1867: 55). *Hyla nigrofrenata*: Günther (1867: 56); Boulenger (1882: 413); Andersson (1916: 15). *Litoria Copei*: Steindachner (1867: 56). *Hyla (Litoria) Wilcoxii*: Keferstein (1868b: 278). *Hyla (Litoria) Copei*: Keferstein (1868b: 278). *Litoria Lesueurii*: Peters (1875: 611). *Hyla affinis*: Boulenger (1882: 413); Fletcher (1898: 682, 684). *Hyla vinosa*: Lamb (1911: 27). *Hyla lesueurii*, var. *vinosa*: Fry (1915: 84). *Hyla tornieri*: Nieden (1923: 228).

Duméril and Bibron's original description (1841: 595) reads: La Rainette de Lesueur. *Hyla Lesueuri*. Nobis. Caractères. Tête courte, plate, élargie en arrière, à côtés antérieurs formant un angle obtus, arrondi au sommet; régions frénales penchées en dedans; un léger sillon longitudinal au-dessous du canthus rostralis; celui-ci distinct, sub-aigu. Yeux assez grands et médiocrement saillants. Tympan petit, circulaire. Langue sub-circulaire, très-faiblement échancrée en arrière, libre dans le tiers postérieur de sa longueur. Trompes d'Eustachi plus petites que les arrière-narines; entre celles-ci, deux rangs de dents vomériennes très-courtes, un peu obliques ou affectant la forme d'un chevron ouvert au sommet. Palais non creusé d'un sillon de chaque côté du sphénoïde. Pas de membrane inter-digitale; palmure des pieds s'étendant presque jusqu'à l'extrémité des orteils. Un renflement glanduleux au coin de la bouche; un autre, descendant du bord de l'orbite sur l'épaule, en s'élargissant; parties supérieures lisses; pas de vessie vocale. Synonymie. *Hyla oculata*. Per. Les. M.S.S. Description. Formes. La tête est au moins aussi large que longue et très-déprimée; sa face supérieure est plane et légèrement inclinée en avant. Les côtés de la mâchoire supérieure sont très-faiblement arqués, ils se rapprochent l'un de l'autre en formant un angle peu obtus ou presque aigu, arrondi au sommet. Les tempes sont perpendiculaires, et les régions frénales un peu penchées en dedans; on remarque un léger creux longitudinal à leur

bord supérieur ou sous le canthus rostralis, qui est aigu et qui s'étend jusqu' au bout du museau en passant au-dessus de la narine. Le museau est convexe. Le contour de la bouche est en demi-cercle un peu forcé. Les yeux saillent au-dessus du crâne; le diamètre de leur ouverture est égal aux trois quarts de la largeur de l'espace inter-orbitaire; celui du tympan, qui est presque ovalaire, n'a guère que la moitié de cette étendue. La langue a la forme d'une ellipse extrêmement courte; elle est adhérente dans les deux tiers antérieurs de sa longueur, et sa marge postérieure est plutôt légèrement infléchie en dedans que réellement échancrée. C'est positivement entre les arrière-narines que se trouvent situées les dents vomériennes, qui forment deux rangs obliques très-courts; si ces rangs étaient contigus, ils donneraient la figure d'un chevron ou d'un angle obtus, ayant son sommet dirigé en arrière. Les narines internes sont peu ouvertes, et les trompes d'Eustachi encore moins; les unes et les autres sont ovalaires. Couchées le long des flancs, les pattes postérieures atteignent au bout du museau par l'extrémité de la jambe; placés de la même manière, les membres thoraciques s'étendent un peu au delà du coccyx. Les doigts sont complètement libres, mais les orteils offrent une palmure qui ne laisse libres que les deux dernières phalanges du quatrième et la dernière seulement des quatre autres. Aux mains et aux pieds, les épaulements du bout des doigts sont circulaires, et d'un diamètre deux fois plus petit que celui de la membrane tympanale. Les renflements sous-articulaires sont médiocrement développés; on ne voit de verrues granuloformes, ni aux faces plantaires, ni aux faces sous-palmaires. Tout le dessus du corps est lisse, le dessous est très-finement granuleux aux régions fémorales et aux abdominales. La peau de la poitrine fait un pli transversal; il existe un cordon glanduleux qui va toujours en s'élargissant depuis l'oeil jusque sur l'épaule; puis on voit une protubérance de même nature derrière le tympan et l'angle de la bouche. Le bord externe du tarse porte un rudiment de membrane flottante. On doit croire que cette espèce ne possède pas de vessie vocale; car, malgré tout le soin que nous avons mis à examiner l'intérieur de la bouche de deux individus qui sont évidemment du sexe masculin, nous n'avons pu y découvrir d'orifices communiquant avec la gorge. C'est jusqu'ici le seul exemple que nous ayons à citer à cet égard parmi les Rainettes.

Coloration. L'un des deux sujets dont nous venons de parler a les parties supérieures d'un brun ardoisé. Le canthus rostralis est marqué d'une ligne noire, une bande de la même couleur s'étend de l'angle postérieur de l'oeil à l'épaule. Le dos est irrégulièrement tacheté de brun très-foncé. Le derrière des cuisses est ponctué de blanc sur un fond d'un noir bleuâtre; ces deux couleurs forment des marbrures sur les mâchoires. Toutes les régions inférieures sont d'un blanc jaunâtre. Chez notre second individu, le dos, bien certainement décoloré, est blanchâtre, et toutes les parties qui, dans le premier, offrent une couleur noirâtre, sont d'un brun marron. **Dimensions.** Tête. Long. 1" 6". Tronc. Long. 2" 5". Memb. antér. Long. 2" 3". Memb. postér. Long. 7" 1". Patrie. Les deux seuls échantillons par lesquels cette espèce nous soit connue proviennent du port Jackson; l'un a été rapporté par Péron et Lesueur, l'autre par MM. Quoy et Gaimard.

Description of No. A.C.3962, an adult female, Tooloom Falls, near Urbenville, northern N.S.W., 9.i.1948:

Habitus large and strong but gracefully built with long, powerful hindlimbs, width of body (33 mm.) 46% of total length of head and body (72 mm.); head subtriangular with rounded outlines, very little broader than long (26.5 × 24.5 mm.); snout moderately long and pointed (12 mm.), 1.7 times diameter of eye (7 mm.), rounded when viewed from above, rounded in profile and projecting about 2 mm. beyond lower lip; canthus rostralis slightly curved, distinctly angular; lores concave; interorbital width equal to that of an upper eyelid (6 mm.), top of head concave with prominent eye bulges; internasal space 5.75 mm.; diameter of eye slightly more than its distance from nostril (6 mm.); tympanum very distinct, decided tilt upwards, contained in diameter of eye 1.4 times (5 to 7 mm.); a well-defined supratympanic fold from eye to above shoulder.

Skin smooth above; chin and throat smooth; abdomen, ventral and about proximal third of posterior surfaces of thighs uniformly and rather coarsely granulate; undersides of limbs except thighs smooth; a fold across breast; a very small, wrinkled anal flap.

Forelimb strong and moderately long (46 mm.), 64% of length of head and body; hand 20 mm.; finger discs not very large but quite distinct, rounded, considerably smaller than tympanum, little more than half its diameter (2.75 to 5 mm.); fingers in order of length, 1=2, 4, 3; no trace of web between fingers; subarticular tubercles large and distinct, rounded except single one of 1st which is much wider than long; palm with a few small and two large flattened tubercles; thumb greatly widened proximally to subarticular tubercle.

Hindlimb strong and long (138 mm.), length nearly twice that of head and body (192%); femur 41 mm., tibia 44 mm., foot 53 mm.; tibiotarsal articulation reaches well in advance of snout; toe discs small but distinct, less than half diameter of tympanum (2.25 to 5 mm.); toes in order of length, 1, 2, 3=5, 4; extent of webbing between toes, 53, 85, 72 and 73%; all toes fringed to discs; subarticular tubercles prominent, rounded; sole divided, otherwise quite smooth; inner metatarsal tubercles large and oval, outer one small, rounded, flattened, about quarter size of inner.

Vomerine elevations strongly developed, paired but closely opposed, transverse, between anterior margins of choanae, no part behind choanae, which are large, elliptic and transverse; tongue subcircular, free and shallowly nicked behind, almost width of mouth.

Dorsal colour light brown with extensive rather obscure dark brown mottling and many black pinpoints; a black line starting half-way between nostril and eye, becomes wide and prominent behind the eye, runs over the tympanum and curves down to end abruptly a little behind the shoulder, it is edged above along its whole length by a narrow whitish line which starts on the snout and runs through the upper eyelid; ventral surfaces clear pale yellow; groin and posterior part of sides boldly marbled with black on light yellow; black markings on lips; posterior surfaces of thighs mainly black irregularly stippled with white circles, figures of eight and script-like markings.

Specimens examined and Locality Records: 1 (R.55, A.M.), Wellington, N.S.W. (H. Barnes), no date; 1 (R.225, A.M.) 25 m. inland from Cairns, Q. (Cairn and Grant), Jan., 1888; 1 (R.2284, A.M.) Bloomfield River, Cooktown, Q. (G. Hislop), Dec., 1897; 2 (R.4350-1, A.M.) Woodford, Blue Mts., N.S.W. (Dene Fry), 9.ii.1909; 1 (R.4366, A.M.) Bundanoon, N.S.W. (E. C. Ross), 9.ii.1909; 1 (R.4480, A.M.) Lindfield, Sydney, N.S.W. (D. B. Fry), no date; 2 (R.4527-8, A.M.) Somerset, Cape York, Q.; 1 (R.4637, A.M.) Horton R., near Bingara, N.S.W. (A. R. McCulloch), Jan., 1910; 1 (R.4818, A.M.) Mt. Cook, Cooktown, Q. (A. R. McCulloch), no date; 1 (R.5001, A.M.) Herberston, Q. (A. J. Vogan), Dec., 1910; 1 (R.5009, A.M.) Cape York, Q. (C. Hedley), Dec., 1910; 1 (R.5325, A.M.) Eidsvold, Q. (Bancroft, Cleland and Johnstone), July, 1911; 1 (R.5373, A.M.) Thirroul, N.S.W. (D. B. Fry), 27.ix.1911; 1 (R.5604, A.M.) Brisbane, Q. (ex. Q. Mus.), Apr., 1912; 1 (R.5868, A.M.) Brisbane, Q. (McCulloch and Troughton), Sept., 1912; 14 (R.6049-52, R. 6054, R.6056-8, A.M.) Norton's Basin, Nepean River, N.S.W. (D. B. Fry), Jan., 1913; 2 (R.6180-1, A.M.) Eidsvold, Burnett R., Q. (T. L. Bancroft), no date; 3 (R.7381-3, A.M.) Burrawang, 20 m. inland from Illawarra, N.S.W., 2000 ft. (J. J. Fletcher), Nov., 1921; 2 (R.7410, A.M.) Pimparna, Q. (J. J. Fletcher), Nov., 1921; 9 (R.7419, R.7423-6, A.M.) Waroo, 60 m. W. of Stanthorpe, Q. (J. J. Fletcher), 8.xi.1921; 3 (R.7498-7500, A.M.) Dunoon, Richmond R., N.S.W. (J. J. Fletcher), Feb., 1922; 1 (R.7591, A.M.) Upper Endeavour River, Q. (J. J. Fletcher), Feb., 1922; 1 (R.7958, A.M.) Moa Id., Torres Strait, Q. (W. H. McClennan), Oct., 1922; 3 (R.7968, R.7970-1, A.M.) Upper Colo, N.S.W. (Kinghorn, Fletcher and Wright), Oct., 1922; 1 (R.9216, A.M.) Williams River, N.S.W. (Musgrave and Campbell), Jan., 1927; 6 (R.9729-30, R.9734, R.10195, A.M.) Groote Eylandt, N.T. (H. E. Warren), 1929-30; 1 (R.9948, A.M.) Brooklana, East Dorrigo, N.S.W. (W. H. Heron), 24.vi.1929; 1 (R.10094, A.M.) Atherton, Q. (G. Curry), 11.iii.1930; 1 (R.10299, A.M.) Hartley, Blue Mts., N.S.W. (H. W. Stein), Dec., 1930; 3 (R.11155-7, A.M.) Tyalgum, Tweed R., N.S.W. (J. Marshall),

Apr., 1934; 1 (R.12275, A.M.) Brogo River, N.S.W. (Consett Davis), 8.vi.1938; 24 (R.12657-73, A.M.) Lowana, Dorrigo, N.S.W. (Mel Ward), Jan., 1943; 1 (R.13111, A.M.) Tenterfield, N.S.W. (R. J. Pullen), 11.xii.1946; 10 (R.14496-14501, R.14515-8, A.M.) Colo Vale, N.S.W. (H. Cogger), 16-30.xii.1954; 6 (A.4914, A.4916, A.4918, A.4921, A.4925-6, A.M.) Yam Creek, 100 m. inland from Port Darwin, N.T. (Alex. Morton); 1 (7326, A.M.) Wagga Wagga, N.S.W., no date; 6 (A.M.) no data; 2 (J.1319-20, Q.M.) Brisbane, Q.; 2 (J.2552-3, Q.M.) Gylanda, Q.; 2 (J.9522-3, Q.M.) Cape York, Q.; 1 (A.C.102) Colo, N.S.W., 18.ix.1938; 1 (A.C.190) Yarramalong, N.S.W., 23.x.1938; 6 (A.C.268-9, A.C.287-90) Kilbride, N.S.W., 16-23.i.1939; 2 (A.C.332, A.C.334) Myall Lakes, N.S.W. (Sydney U. Party), 20-29.viii.1934; 2 (A.C.380, A.C.485) Campbelltown, N.S.W., 1939; 1 (A.C.3708) 11 m. S.W. of Nymboida, N.S.W., 30.xii.1947; 14 (A.C.3741, 3818-22, 3824-6, 3839-42, 3844) Horton's Creek, 5 m. from Nymboida, N.S.W., 31.xii.1947; 1 (A.C.3848) 7 m. W. of Grafton on Armidale Road, N.S.W., 6.i.1948; 44 (A.C.3898, 3900-6, 3908-24, 3926-39, 3962-6) Tooloom Falls, near Urbenville, N.S.W., 8-9.i.1948; 1 (A.C.3971) Thane Creek, W. of Warwick, Q., 10.i.1948; 4 (A.C.4544-7) Kilbride, N.S.W., 17.i.1950; 1 (A.C.5097) Bluff Rock, near Tenterfield, N.S.W., 26.xii.1954; 6 (A.C.5145-50) Reid's Creek, 5 m. W. of Gayndah, Q., 1.i.1955; 3 (A.C.5174, 5177, 5179) O Bil Bil Creek, 10 m. N.W. of Mundubbera, Q., 3.i.1955; 1 (A.C.5195) Fiery Creek, 21 m. W. of Eidsvold, Q., 4.i.1955; 1 (A.C.5294) Wowan, Q., 10.i.1955; 4 (A.C.5316-7, 5319-20) Takilberan Creek, 23 m. N. of Gin Gin, Q., 13.i.1955; 3 (A.C.5481, 5485-6) Galston Gorge, N.S.W. (J. and C. Copland), 3-17.iv.1955; 2 (A.C.5776, 5780) Bombala, N.S.W., 26.xii.1955; 1 (A.C.5970) Chandler's Creek, 22 m. N. of Cann River township, V., 27.xii.1955; 4 (A.C.5981-4) Horsham, V., 3.i.1956; 1 (A.C.6155) 28 m. from Armidale on Bundarra Road, N.S.W. (R. Pengilley), 1956; 1 (A.C.6157) Warrawee, N.S.W., 24.xii.1956; 1 (R.3648, S.M.) Woodridge, Q. (W. Hosmer), 26.ix.1954; 1 (D.7705, N.M.) Gelantipy, V.; 2 (M.C.Z.1929) Sydney, N.S.W. (Göttingen Mus.), 1885; 2 (M.C.Z.3598-9) Norton's Basin, N.S.W. (Australian Mus.), 1914; 1 (M.C.Z.3606) Brisbane, Q. (Australian Mus.), 1914; 4 (M.C.Z.18126) Salisbury, N.S.W. (P. J. Darlington), 1932; 5 (M.C.Z.18127-31) Millaa Millaa, Q. (P. J. Darlington), 1932; 6 (M.C.Z.18132, 18496-500) Lake Barrine, Q. (P. J. Darlington and W. E. Schevill), 1932; 1 (M.C.Z.18490) Wengen Creek, Bunya Mts., Q. (W. E. Schevill), 1932; 1 (M.C.Z.18491) Mundubbera, Q. (W. E. Schevill), 1932; 1 (M.C.Z.19250) National Park, Q. (F. N. Blanchard), 1928; Port Jackson, Sydney, N.S.W., two types of *lesueurii*, vide Duméril and Bibron (1841: 595); Port Essington, N.T., type of *affinis*, vide Gray (1842: 56); Cape York, Q., type of *nigrofrenata*, vide Günther (1867: 56); Ithaca Creek, Brisbane, Q., type of *vinosa*, vide Lamb (1911: 27); M'Allister and Wellington Rivers, V., vide Lucas (1892: 61); Comboyne Plateau, vide Chisholm (1926: 296); Bulli, Springwood, Mudgee, Dunoon, Illawarra, Burrawang, Clifton, Guntawang, Cullenbone, all in N.S.W.; Pimpana, Waroo, both in Q., see Fletcher; Atherton, Malanda, Cape York, Q., vide Andersson (1916: 15); Oenpelli, N.T., vide Mitchell (1955: 404).

All 230 A.M., Q.M., S.M., N.M., and A.C. specimens, except R.7410, have been examined.

Variation.—Only 26 of the 229 specimens examined had the snout equal in length to the distance between the anterior corners of the eyes; in all the rest the snout was shorter. The eye bulges of *lesueurii* are nearly always prominent, unlike *latopalmata*, where they are usually flattened. A few specimens have the upper eyelids slightly warty with odd warts scattered about the dorsum, but never to the extent shown in *latopalmata*, except for R.7958, which is unusual in that the back is plentifully sprinkled with small warts. Generally the dorsum is quite smooth. The diameter of the eye may equal, not exceed, its distance from the nostril. In the Queensland Museum frogs the heel reaches to well in front of the snout in the Brisbane and Cape York specimens, very slightly so in the Gylanda ones. The outer metatarsal tubercle is practically always distinguishable, although it may be very small. The vomerine elevations are normally strongly developed, narrowly separated, transverse and between the anterior margins of the choanae, as in A.C.3962; in a good few cases the elevations are rather smaller and more widely separated; in 12 cases they are low and oblique; and in 21 small and rounded. Two of the Tooloom Falls specimens and one from Horton's Creek

are interesting in having the pair united into a single transverse elevation. The tongue may be elliptical and considerably narrower than the mouth. There is much variation in general coloration. The dorsum may range from uniform light grey to dark reddish-brown, or blackish markings may be extensive. Almost white specimens are not uncommon. Keferstein (1868a: 355) probably described one of these light frogs as his *Freycinetii* var. *unicolor*. A.C.332 from Myall Lakes is unusual in having large black patches, which at times are confluent, on the back and sides. A few others as R.12667 are very heavily blotched with black dorsally. Sides and groins are sometimes as in the Lowana frogs and A.C.3930 from Tooloom Falls very boldly marked with black. A few other specimens may have many tiny black dots. Of 229 specimens 189 had the typical pattern of a black plate, islanded with white or yellow ocelli, figures of eight, dumbbell and other shapes, covering most of the posterior surface of the thigh. This characteristic is often very plain in even small individuals, but is most beautifully shown in the large females. The white ocelli and other figures often surround a black spot. Another 32 specimens had light islands in black, but the black plate was broken up to some extent or occasionally restricted to about a third of the posterior surface of the thigh. Only eight frogs had faint, doubtful white and black markings.

Discussion.—The type description is very full and accurate, and gives what is practically characteristic of the species—the colour pattern on the posterior surfaces of the thighs. Duméril and Bibron say that the vomerine elevations were separate, very short and a little oblique. This falls well within the range of variation. They stress the smoothness of the dorsal surfaces. One of their specimens had dark markings on the back and the second was whitish. Nieden (1923: 235) gives an almost literal translation of Boulenger's description (1882: 412). Boulenger includes the types of Günther's *Litoria wilcozii* from the Clarence River in *lesueurii*. Günther's description of his *nigrofrenata* falls well within the range of variation of *lesueurii* and was placed in the synonymy by Loveridge (1935: 51). There is no doubt that Lamb's *vinosa* (1911: 27) from Ithaca Creek, Brisbane, is a synonym of *lesueurii*. The description tallies in all points, even to such details as the white spots behind the thighs with a blackish centre, with specimens examined by me. Lamb thought that his species differed from *nigrofrenata*, a synonym of *lesueurii*, int. al. in the contiguous vomerine elevations, but this occurs in several specimens as discussed under the heading of variation. Fry (1915: 84) redescribed and figured the type specimen. He regarded *vinosa* as a "good geographical race" of *lesueurii* in the belief that northern Queensland specimens were larger and had relatively much larger discs than the typical form. It may be mentioned here that the type of *vinosa* measured 52 mm. while A.C.3962 was 72 mm. Loveridge has dealt quite fully with these points. I follow Loveridge in placing *Pelodryas affinis* Gray (1842: 56) from Port Essington in the synonymy of *lesueurii*, but Gray's description of *affinis*, although short, appears to differ from that of typical *lesueurii* in several details including "a large squarish spot enclosing the tympanum purplish, lips white, and palatine teeth in two roundish groups". A large collection from the Northern Territory might show *affinis* to be a subspecies, but Boulenger (1882: 413) redescribed and figured *affinis* from the Port Essington type and included a specimen from Rockhampton. The redescription falls within the range of *lesueurii* as understood here. Mitchell (1955: 404) says that a specimen from Oenpelli, N.T., agreed well with both Günther's type description and Boulenger's redescription and figure of the type of *nigrofrenata*. Fletcher (see synonymy) has about 18 references to this species mainly dealing with distribution and habits. There seems little doubt that *Litoria Copei* Steindachner (1867: 56) should be referred to the synonymy. Dr. A. Keast and Miss Gabrielle Smith showed me an interesting series of about a dozen specimens collected on 25th November, 1956, in National Park near Sydney. Colour of the backs varied from light parchment through various shades of grey and light and dark browns. Limbs and sides of two were greenish. Most were uniform dorsally, but about a third had large insuliform dark spots. The hinder sides of the thighs were black surrounded by shining light blue and with the blue as spots.

HYLA LATOPALMATA LATOPALMATA (Günther).

Synonymy and references: *Litoria punctata*: Duméril (1853: 149); Günther (1858: 145); Loveridge (1935: 53). *Litoria latopalmata*: Günther (1867: 55). *Hyla (Litoria) punctata*: Keffersstein (1868b: 277). *Hyla dimolops*: Cope (1869: 163); Fletcher (1889: 386; 1890: 668, 671, 675; 1892: 11; 1894: 526, 530). *Hyla latopalmata*: Boulenger (1882: 414); Fletcher (1889: 360, 371, 385; 1890: 671, 673; 1892, 9, 13; 1894: 525, 530; 1898: 681, part); Fry (1913: 20); Nieden (1923: 227); Waite (1929: 262) Loveridge (1935: 52; 1950: 132).

Günther's original description (1867: 55) reads: *Litoria latopalmata*, sp. n. Snout of moderate length, somewhat pointed in front, the distance between the front angles of the orbit being equal to that between the eye and the extremity of the snout. Canthus rostralis rather obtuse; nostril much nearer to the end of the snout than to the eye. Tympanum very distinct, not much smaller than the eye. Back with a few indistinct, short, glandular folds or tubercles. Vomerine teeth in two oblique short series between the choanae. Tongue with scarcely a trace of a notch behind. Openings of the Eustachian tubes at least as wide as the choanae. Limbs rather slender, the third finger much longer than the fourth. The length of the body is less than the distance between vent and heel. Tarsus with a lateral fold of the skin. Metatarsus with two small tubercles, the inner being minute. Toes broadly webbed, the web extending to the disks of the third and fifth toes. The length of the fourth toe is one-half that of the body. Disks small.

Upper parts reddish-olive, with numerous small irregular brown spots. An irregular brown cross band between the eyes. A brown streak along the canthus rostralis; tympanum in front and behind with a narrow deep-brown margin. Hinder surface of thighs marbled with brown, as the upperside. Length of the body 18 lines, width of cleft of the mouth $5\frac{1}{2}$ lines, length of forelimb 12 lines, length of third finger 3 lines, length of hindlimb 33 lines, length of entire foot 14 lines, length of fourth toe 9 lines. Two specimens from Port Denison (Krefft, 11).

Description of No. A.C.5267, a male, probably adult, 1 m. N. of Baralaba, Q., 7.1.1955.

Habitus very slender, total length of head and body 40 mm.; head pointed, subtriangular, somewhat longer than broad (15×12.5 mm.); snout long (7 mm.), 1.9 times diameter of eye (3.75 mm.), pointed, tip again pointed with a shallow vertical concavity on each side in front of the nostrils, rounded in profile, considerably overhanging lower lip; canthus rostralis angular, extending practically to tip of snout; lores only slightly concave; interorbital width just more than that of an upper eyelid (3.5 to 3 mm.), top of head almost flat and eye bulges indistinct; internasal space 3.5 mm.; diameter of the eye equals its distance from nostril; tympanum very distinct, a decided tilt upwards, contained in diameter of eye about 1.3 times (3 to 3.75 mm.), distance from eye 1.5 mm.; no supratympanic fold.

Skin nearly smooth above; a little wartiness on the upper eyelids; chin, throat and a small part of belly anteriorly smooth; remainder of belly with most of lower posterior and posterior ventral surfaces of thighs uniformly granular; limbs smooth; a distinct, seam-like fold across chest; a small, wrinkled anal flap.

Forelimb long and slender (24 mm.), 60% of length of head and body; hand 11 mm.; finger discs very small, but rounded and distinct, one-quarter diameter of tympanum (0.75 to 3 mm.); fingers in order of length, 2, 1, 4, 3, 1st only a shade longer than 2nd, slender; no webbing between fingers; subarticular tubercles small but quite distinct, rounded; palm with large medial tubercle; base of thumb enlarged.

Hindlimb long and slender, length (70 mm.) 175% of head and body; femur 17 mm., tibia 23 mm., foot 30 mm.; heel reaches exactly to tip of snout; toe discs very small but distinct, rounded, one-third diameter of tympanum (1 to 3 mm.); toes in order of length, 1, 2, 3 = 5, 4, very long and slender, especially 4th; extent of webbing between toes, 55, 63, 80 and 63%; toes with extremely narrow fringes to discs; sub-articular tubercles rounded, small but very prominent; sole fairly smooth; inner metatarsal tubercle elongated and prominent, outer small and flattened.

Vomerine elevations paired, oblique, convergent posteriorly, fairly widely separated, mainly oval with a somewhat flattened side directed postero-laterally, anterior edges

a little in front of choanae, hinder edges entirely in front of a line joining the posterior corners of the choanae, which are large and elliptical; tongue subcircular, free behind with a very shallow indentation, anterior two-thirds fills width of mouth; no external subgular vocal sac.

Dorsal colour greyish-brown with irregular black markings, which are roughly arranged in three longitudinal lines running back from an irregular patch which covers and connects both upper eyelids, the vertebral streak is much broken up, the two dorsolateral ones although discontinuous are much plainer; a black streak from nostril runs through eye and tympanum and dies out behind the shoulder; groin and forepart of thighs with a broken line of black spots; a thin black, very distinct line along preaxial side of tibia and almost to toes; a few indistinct black spots on sides and head; lips barred with dark brown, or perhaps better for upper lip brownish with white spots; chin, throat and forepart of belly pure white; remainder of ventral surfaces whitish with a yellow tinge; non-granulated area, which becomes wider distally, of posterior surfaces of thighs boldly marbled with black on yellowish-white.

Specimens examined and Locality Records: 6 (R.4301-5, R.4307, A.M.) Darling River, N.S.W. (R. Helms), May-June, 1890; 8 (R.5342-7, A.M.) Eidsvold, Burnett River, Q. (T. L. Bancroft), Aug., 1911; 2 (R.5501-2, A.M.) Eidsvold, Q. (T. L. Bancroft), Feb., 1912; 1 (R.5827, A.M.) Eidsvold, Q. (T. L. Bancroft), Aug., 1912; 2 (R.5867, A.M.) Brisbane, Q. (McCulloch and Troughton), Sept., 1912; 3 (R.6059-61, A.M.) Norton's Basin, Nepean R., N.S.W. (D. B. Fry), Jan., 1913; 1 (R.6331, A.M.) Eidsvold, Q. (T. L. Bancroft), Nov., 1913; 2 (R.7414, A.M.) Waroo, Inglewood, 60 m. W. of Stanthorpe, Q. (J. J. Fletcher), Nov., 1921; 8 (R.7465-8, A.M.) Dandaloo, Bogan River, N.S.W. (J. J. Fletcher), Feb., 1922; 4 (R.8469-70, A.M.) Nepean River, N.S.W. (Thomas Steel), Nov., 1924; 1 (R.8699, A.M.) Gouldsville, 10 m. from Singleton, N.S.W. (W. Flick), Jan., 1924; 3 (7056 and two other A.M. specimens) no data; 1 (A.C.630) Balonne River, 10 m. S.W. of St. George, Q., 15.xi.1939; 10 (A.C.3975-6, A.C.3978-85) McIntyre Brook, near Whetstone, Q., 11.i.1948; 1 (A.C.4035) Whalan Creek, 12 m. S. of Boggabilla, Q., 12.i.1948; 1 (A.C.4044) Jack Hall's Creek, 9 m. S. of Coonabarabran, N.S.W., 15.i.1948; 1 (A.C.4218) 4 m. N. of Fairford, N.S.W., 6.i.1949; 1 (A.C.4977) Condamine River, near Chinchilla, Q., 15.i.1953; 3 (A.C.5110, A.C.5112-3) Condamine River, near Warra, Q., 29.xii.1954; 1 (A.C.5164) Fox Creek, 11 m. E. of Mundubbera, Q., 3.i.1955; 1 (A.C.5175) O Bil Bil Creek, 10 m. N.W. of Mundubbera, Q., 3.i.1955; 3 (A.C.5194, A.C.5197-8) Fiery Creek, 21 m. W. of Eidsvold, Q., 4.i.1955; 10 (A.C.5260-5270) 1 m. N. of Baralaba, Q., 7.i.1955; 1 (A.C.5272) 11 m. N. of Moura, Q., 7.i.1955; 1 (A.C.5353) Takilberan Creek, 23 m. N. of Gin Gin, Q., 14.i.1955; 1 (A.C.5382) 8 m. S.E. of Calliope, Q., 12.i.1955; 1 (A.C.5448) between Eidsvold and Wowan, Q., 4-11.i.1955; 1 (A.C.6154) 28 m. from Armidale on Bundarra Road, N.S.W. (R. Pengilley), 1956; 1 (J.295, Q.M.) Eidsvold, Q.; 2 (J.9524-5, Q.M.) Burpengary, Q.; 1 (J.9526, Q.M.) Mackay, Q.; 1 (R.3738, S.M.) St. George, Q. (W. Hosmer), 25.ix.1955; 1 (M.C.Z.3618) Norton's Basin, N.S.W. (Australian Mus.), 1914; 1 (M.C.Z.3619), Eidsvold, Burnett R., Q. (Australian Mus.), 1914; 4 (M.C.Z.18492-5) Rutherford, Sellheim R., Q. (W. E. Schevill), 1932; Port Denison, Q., types, vide Günther (1867: 55); South Creek, St. Marys, N.S.W., vide Fry (1913: 22).

Variation.—Günther (1867: 55) noted that the distance between the anterior corner of the eye and the tip of the snout is equal to that between the anterior corners of the eyes. This is true for 44 of the 84 specimens examined, but in 40 cases the snout is slightly or quite markedly longer. The dorsum can never be described as perfectly smooth. The upper eyelids are always and characteristically warty, and there are invariably a few rounded or mildly elongated warts scattered over the back. These are generally flattened and never very prominent. R.5342, A.M. and R.3738, S.M. can almost be described as smooth, but they have an odd wart or two in addition to those of the eyelids. Vomerine elevations are much as in A.C.5267, but in two Waroo, two Nepean River and an Eidsvold frog they are much smaller and rounded. Of 84 frogs 14 have the distinctive dark pattern of Boulenger's plate; 60 have the pattern much fainter but retain the blackish interorbital patch much as in Fry's figure; 10 have plain backs devoid of pattern. All specimens have the characteristic black pattern on

yellow behind the thighs. This is illustrated by both Boulenger and Fry. An odd specimen as A.C.5265 may have the chin and throat rather heavily reticulated with dark brown, or there may be a general darkening without pattern. However, about 70% of all specimens have the chin and throat immaculate white.

Discussion.—Loveridge (1935: 52) made a valuable contribution towards clarifying this species. He places *dimolops* Cope (1869: 163) originally Duméril's *punctata* (1853: 149) from Sydney in the synonymy after comparing his specimen from Norton's Basin with Duméril's original description and noting that the narrow lateral glandular fold used in Boulenger's key to the Hylidae (1882: 346) may or may not be present. In fact it occurred on one side and was absent on the other in the Norton's Basin frog. He comments on the close relationship of *latopalmata* and *lesueurii* as follows: "I judge that *latopalmata* can best be separated from its near ally *lesueurii* by its narrower head and habit. In addition No. 3618 (the Norton's Basin frog) differs from two *lesueurii* from the same locality in its dorsal punctate blotches; apart from this the markings are strikingly similar and it is not a little surprising to find two such closely related species occurring in the same locality." Nieden's description (1923: 227) is very much that of Boulenger (1882: 414). Fry gives a rounded discussion of the species (1913: 20) including redescription, figures, notes on distribution and a comparison with *freycineti*. Fry's frogs were collected about Eidsvold on the Burnett River in Queensland. Fry says "Dr. Bancroft has forwarded a fine series of this rare frog, and as his specimens show considerable differences from Dr. Boulenger's description of the type, I have redescribed the species". As far as I can see Boulenger's description is a very accurate one and tallies with Eidsvold specimens. Fry quotes from Krefft (Austr. Vertebrata Fossil and Recent, 1871, p. 63) "We believe this to be a well distributed species which occurs at Adelaide, near Sydney, and probably in the intermediate district". Fry remarked that this Adelaide record was the only one of *latopalmata* south of Sydney. Waite (1929: 262) reproduces Boulenger's figure and says "It is rather doubtful if the identification of this frog from Adelaide is correct, for it does not appear to have been recognized here since first recorded by Krefft in 1871. If a denizen of this State, it is much more likely to occur nearer the northern borders". Fletcher (see synonymy) gives about a dozen notes on habits and distribution. Because the ranges of *latopalmata* and *lesueurii* are so largely coextensive and they are so closely allied, it seems probable that the two were confused by many early authors. *Latopalmata* is a slimmer species than *lesueurii* with a more pointed snout, a dorsal pattern which is characteristic when present, and the fact that the posterior surfaces of the thighs are marked boldly with black or dark brown on a yellow or yellowish-white ground. Specimens do not have the large black area marbled with white islands, figures of eight and similar enclosed figures peculiar to *lesueurii*. Excluding the doubtful Adelaide record *Hyla l. latopalmata* extends from National Park, just south of Sydney along the coast to well past Mackay. Although it is mainly a coastal form it occurs on the highlands and western slopes with extensions down the streams of the western rivers to the Darling.

HYLA LATOPALMATA WATJULUMENSIS, subsp. nov.

Synonymy and references: *Hyla latopalmata*: Fletcher (1898: 681-2); Fry (1914: 209); Loveridge (1935: 52). *Hyla affinis* (non Gray): Andersson (1913: 24); Loveridge (1935: 51-3).

Specimens examined and Locality Records: 1 (R.6011, A.M.) Napier, Broome Bay, W.A. (W.A. Museum); 3 (R.10491, 10499, 10501, W.M.) Napier, Broome Bay, W.A.; 2 (R.8733-4, W.M.) Thompson's Spring, Argyle Station, W.A.; 29 (R.11195-9, R.11633-5, R.11638, R.11896-11907, R.11932-9, W.M.) Watjulum Mission, W.A.; 1 (M.C.Z.18000) Kimberley Division, W.A. (E. Mjöberg), 1910-1911; King's Sound and Kimberley, W.A., vide Fry (1913: 22); Jeddah, Noonkambah, St. George Range, all in Kimberley Division, W.A., vide Andersson (1913: 24); King's Sound (Macleay Museum; one adult collected by Mr. W. W. Froggatt); Kimberley, N.W.A. (Mr. R. Helms; four specimens, not quite half grown), vide Fletcher (1898: 681).

Discussion.—The Western Australian race is differentiated by habitus and coloration. The snout is both longer and sharper with almost straight sides to the head and a pointed tip to the snout. The distance between the anterior corner of the eye to the tip of the snout is always markedly longer than the distance between the anterior corners of the eyes. The ratio is practically invariable at 120%. All frogs lack the dorsal pattern characteristic of *I. latopalmata*, and are generally bluish in preservative, not brownish. Of 23 individuals, 10 had the dorsum practically uniform dark blue, three were nearly uniform grey, three grey except for a little obscure dark mottling, five had an irregular piebald pattern about half light and half dark, while two were heavily dark spotted. The posterior surfaces of the thighs are reticulated with black on white or whitish-grey, not yellow. The black is frequently so extensive that it occurs as a plate reminiscent of *lesueurii* and the white appears as spots or irregular figures. This is unlike the eastern Australian pattern of *I. latopalmata*. Vomerine elevations are much the same as those of the typical form, but are perhaps a little more transverse and set a trifle more forward. The type locality Watjulum Mission is close to Yampi Sound, north of King Sound. Andersson (1913: 24) had six specimens from the Kimberley area, which he identified as *affinis*. He says "in all specimens the under side of the thighs is more or less marbled with black and white". This is not the case with eastern frogs. Loveridge (1935: 51) records that he had examined one of the frogs referred to *affinis* by Andersson and found it to be *latopalmata*.

HYLA JENOLANENSIS, sp. nov.

Description of R.14412 in the Australian Museum, an adult female, from creek bed near Bottomless Pit, Jenolan Caves, N.S.W., collected by C. Sander (C.S.I.R.O.), 18.iii.1954:

Habitus slender with a broad, flattened head and narrow body tapering back to a thin waist; total length of head and body 62 mm.; head subtriangular, slightly wider than long (21 × 20 mm.); snout short (10 mm.), one and a third times diameter of eye (7.5 mm.), broadly truncate when viewed from above, very slightly rounded but almost vertical in profile, extending very little beyond lower lip; canthus rostralis rounded in front, a short straight angular section behind; lores slightly concave, sloping obliquely inwards; interorbital width not quite twice that of an upper eyelid (7 to 4.5 mm.), the top of the head flattish between prominent eye bulges; internasal space 5 mm.; eye large and rounded, set deeply in jaw, its diameter slightly more than its distance from nostril; tympanum only moderately distinct, round, tilted slightly upward, contained twice and a half in diameter of eye (3 to 7.5 mm.), distance from eye 2 mm.; a hardly distinguishable supratympanic fold.

Skin smooth but minutely pitted especially on the head; chin and throat practically smooth; body and proximal areas behind thighs very finely granular; limbs below smooth; no pectoral fold; anal flap very small.

Forelimb rather thin and long (42 mm.), 68% of length of head and body; hand 18 mm.; finger discs small, spatulate, considerably longer than wide, about two-thirds size of tympanum (2 to 3 mm.); fingers in order of length, 1, 2, 4, 3; the extremities have become dried but the extent of webbing between the fingers is about 27, 40 and 32%; fringes practically absent; subarticular tubercles rounded, distinct but not prominent; palm divided; thumb broadly expanded basally.

Hindlimb long and slender, length (100 mm.) 161% of head and body; femur 29 mm., tibia 29 mm., foot 42 mm.; heel reaches nearly to nostril; toe discs much as those of fingers but smaller, half size of tympanum (1.5 to 3 mm.); toes in order of length, 1, 2, 3, 5, 4; extent of webbing not determinable because of drying but appears to be less than half; fringes practically absent; subarticular tubercles low and rounded; sole fairly smooth; a narrow tarsal fold; an elongated inner metatarsal tubercle, no outer one.

Vomerine elevations moderately robust, paired, oblique, convergent posteriorly, well separated, beginning near the anterior corner of the choanae the larger posterior half of each elevation is behind a line joining the posterior corners of these rather large

openings; tongue almost round, free behind with only the merest trace of an indentation.

The dorsal surface of the head and body has a very light brown ground colour. It is closely spotted and reticulated all over with a rich medium brown. The upper eyelids are in sharp contrast being a coarse network of black and white. A very thin, inconspicuous white line runs from the eye almost dorsolaterally more than half-way down the side. Two or three white patches form a broken line from the angle of the jaw to the shoulder. There is a good deal of white under the eye and on the upper jaw as well as an indistinct white streak along each of the lores. The underside of head, body and limbs is immaculate white except for a brown rim round the margin of the lower jaw. The dorsal surfaces of the limbs including a narrow strip on the thighs but not the upper arms are spotted or reticulated much as the dorsum. Posterior surfaces of the thighs are very pale yellow.

Discussion.—It is normally poor practice to establish a species on a single specimen, but I am fairly confident in this case. At least I am certain that the Jenolan Caves frog differs from all of many others I have seen from areas about Sydney. The vomerine elevations in *jenolanensis* are set farther back than in *lesueurii*, being more than half behind the line joining the posterior borders of the choanae. They are also widely separated and rather triangular in shape. The body is flattened and tapers back from the wide head to a narrow waist. There are in addition at least three striking differences in colour. The posterior surfaces of the thighs are uniform plain yellowish-white with a marbled area restricted to the dorsal surface of the limb. The upper eyelids are beautifully reticulated in black and white, and the general ground colour of the dorsum is very light brown spotted and reticulated all over with a darker brown.

HYLA KINGHORNII Loveridge.

Synonymy: *Hyla kinghorni*: Loveridge (1950: 132).

Loveridge's original description (1950: 132) reads: *Hyla kinghorni*, sp. nov. Type.—California Academy of Sciences No. 83,234, an adult ♂ from Ulong, northeastern New South Wales. Collected by J. R. Slevin, January 28, 1948. Diagnosis.—Apparently most nearly related to *Hyla latopalmata*, from which it may be distinguished as follows:

Canthus rostralis sharply angular; interorbital space two-thirds the width of an upper eyelid; vomerine teeth in two juxtaposed groups; first finger as long as second; toes from first to fifth have $\frac{1}{2}$, 1, 1, $1\frac{1}{2}$, and 0 terminal joints respectively free of web .. *kinghorni*, sp. nov.

Canthus rostralis obtusely rounded; interorbital space $1\frac{1}{4}$ - $1\frac{1}{2}$ times the width of an upper eyelid; vomerine teeth well separated; first finger longer than second; toes from first to fifth have 0, 0, 0, $1\frac{1}{2}$, and 0 terminal joints respectively free of web .. *latopalmata* Günther.

Description.—Head as long as broad; snout subacuminate, its length (to anterior corner of eye) equal to the distance separating the anterior corners of the eyes; nostril considerably nearer the end of the snout than it is to the anterior corner of the eye; *canthus rostralis* sharply angular; loreal region oblique, slightly concave; interorbital space two-thirds the width of an upper eyelid; diameter of tympanum rather more than half that of the eye; tongue large, subcordiform, distinctly emarginate behind, slightly free; vomerine teeth strongly developed in two juxtaposed, slightly oblique groups between the choanae. Fingers free of web, first as long as second, which is shorter than fourth, which is shorter than the third, disk of third only half diameter of tympanum; toes well webbed, the web extending almost to the disk on the first, to the distal subarticular tubercle on the second and third, as a narrow margin to the distal tubercle on the fourth, and to the disk on the fifth; in other words, the terminal joints free of web from first to fifth are $\frac{1}{2}$, 1, 1, $1\frac{1}{2}$, and 0; subarticular tubercles prominent; an oval inner, but no outer, metatarsal tubercle; tibio-tarsal articulation of the adpressed hindlimb reaches beyond end of snout. Skin above smooth; an indistinct curved supra-tympanic fold; forearm smooth, without dermal ridge or series of tubercles; being a male, there is a partly pigmented nuptial swelling at base of first finger; neither lappet on heel nor dermal ridge along outer edge of foot. Below, throat smooth; breast, belly, and thighs granular. Colour.—Above, pale grey variegated with light-edged black

patches that coalesce erratically; from nostril through eye to above forearm an ill-defined dark streak; flanks with a few black spots; thighs with slight marbling on distal half of hinder side only. Below, white, a faint trace of dusky pigmentation around lower jaws; otherwise uniform, becoming yellowish cream on belly and buttocks. Size.—Total length from snout to anus of holotype ♂, 45 mm.; hindlimb 80 mm. Remarks.—Named for J. Roy Kinghorn, Esq., of the Australian Museum, whose ever-ready helpfulness is known to all visiting herpetologists. This new hylid has been compared with all related forms of the twenty-three species of Australian *Hyla* in the collections of the Museum of Comparative Zoölogy, as listed by me (1935, Bull. Mus. Comp. Zool., 78, pp. 37-54).

Description of type, No. 83,234 of the California Academy of Sciences, now R.13,818 in The Australian Museum, an adult male, Ulong, North Coast of New South Wales, 28.i.1948 (J. R. Slevin):

Habitus rather slender, thinning back evenly from broad head to narrow waist, greatest width of body (at shoulders) 15 mm., 33% of total length of head and body (45 mm.); head subtriangular with a rounded outline, about as broad as long (16 to 17 mm.); snout moderate (8 mm.), 1.6 times diameter of eye (5 mm.), obtusely pointed when viewed from above, rounded and receding to lip in profile; canthus rostralis straight, reasonably distinct; lores almost flat, sloping obliquely inwards at about 45° from jaw to canthus rostralis; interorbital width not much more than that of an upper eyelid (3.5 to 3 mm.), top of head rather flat and eye bulges not very distinct; internasal space 3.75 mm.; diameter of eye equals its distance from nostril; tympanum very distinct, directed slightly upward, contained in diameter of eye 1.7 times (3 to 5 mm.), distance from eye 1.5 mm.; almost unnoticeable supratympanic fold.

Skin smooth above; chin, throat and underside of limbs, except thighs, smooth; belly and practically the whole of the ventral surface of thighs granular; indistinct fold across breast; a very small anal flap.

Forelimb strong, fairly long (28 mm.), 80% of length of head and body; hand 12 mm.; finger discs rounded, small, little more than half diameter of tympanum (1.75 to 3 mm.); fingers in order of length, 1 = 2, 4, 3; fingers devoid of webs or fringes; subarticular tubercles rounded, rather small but quite distinct; a few indistinct supernumerary tubercles and a large, proximal palmar one; thumb with large swollen basal pad and dark thickened area on inner side.

Hindlimb strong and long, length (88 mm.) 196% of head and body; femur 25 mm., tibia 27 mm., foot 36 mm.; heel reaches well in front of snout; toe discs very small, hardly wider than toes, squarish, one-third diameter of tympanum (1 to 3 mm.); toes in order of length, 1, 2, 3 = 5, 4; extent of webbing between toes, 33, 52, 67 and 75%, web extends practically to discs of 1st and 5th toes; fringing of toes very narrow or practically absent; subarticular tubercles rounded, small but distinct; sole divided longitudinally but fairly smooth; a small inner metatarsal tubercle which is about one-quarter the size of the large outer one.

Vomerine elevations paired, narrowly separated, well-developed, transverse, posterior sides bearing minute teeth, totally contained between choanae, each the size of one of the choanae, which are large, and separated from it by about half its width; tongue somewhat longer than wide and wider in front than behind, where it is free and feebly notched. Width about half that of mouth at angle of jaws; no external vocal sac.

Dorsal colour pale yellowish-grey, many black markings without orientation ranging from extensive irregular marbling through large spots to minute flecks but ground colour is never in doubt, limbs progressively lighter distally; back of thighs, particularly distal two-thirds, marbled in black and white; a black streak from snout, through eye, over tympanum to above shoulder, ventral surfaces white, chin and throat immaculate, belly and limbs with yellowish tinge.

Specimen examined and Locality Record: 1 (R.13818, A.M.) Ulong, Dorriggo Dist., N.S.W. (J. Slevin), Jan. 28, 1948.

Discussion.—The type and apparently the unique specimen collected was carefully compared with a large series of *latopalmata* with a prejudged impression that it was at most a race of that species. It is undoubtedly very close to *latopalmata*, with which

it agrees in having the distance between the anterior corners of the eyes equal to that between the eye and the tip of the snout, and with having a dark band between the eyes and in its very irregular dark dorsal pattern a trace of the three longitudinal lines. However, the upper jaw is less pointed than in *latopalmata* and the lower jaw is almost semicircular and not distinctly U-shaped. The dorsum is quite smooth and the upper eyelids without the wartiness of *latopalmata*. The vomerine elevations are transverse and closely opposed instead of being well separated. The black pattern behind the thighs is on grey, not yellow, and the lower jaw is almost immaculate white without a trace of the marginal short dark bars practically characteristic of *latopalmata*. It seems wise to consider *kinghorni* as a separate species at least until additional specimens clarify the position.

HYLA NASUTA (Gray).

Synonymy: *Pelodytes nasutus*: Gray (1842: 56). *Litoria nasuta*: Günther (1858: 97; 1867: 55); Krefft (1865: 18, 19); Steindachner (1867: 56). *Hyla (Litoria) nasula*: Keferstein (1868b: 277). *Hyla nasuta*: Boulenger (1882: 415; 1885: 387); Fletcher (1892: 11; 1893a: 232; 1894: 525, 530; 1898: 682, 684); Lucas and Le Souef (1909: 292); Kampen (1909: 35; 1923: 27, 64); Andersson (1913: 25; 1916: 15); Fry (1912: 100; 1914: 210); Nieden (1923: 206); Noble (1931: 510); Loveridge (1935: 54; 1949: 214); Mitchell (1955: 405). *Hyla peninsulæ*: De Vis (1882: 130). *Hyla semoni*: Boettger (1894: 112) vide Nieden (1923: 206).

Gray's original description (1842: 56) reads: *Pelodytes nasutus*. Nose rather produced, conical. Purplish brown, in spirits, with a broad whitish streak on the end of the nose, divided behind into two lines extended down the middle of the back to the groin, and some cross lines and a central streak on the loins, an irregular grey streak on each side and a spot on the front of forearm; an ovate white spot from the angle of the gape to the shoulder; sides, lower jaw, back and thighs purplish marbled; chin, underside of body and legs white; belly and hinder part of thigh granular; the front toes free, the hinder elongate, webbed, all with roundish tubercles beneath, and with a roundish tubercle on the ankle; tympanum large; palatine teeth in 2 roundish groups; tongue oblong, slightly nicked behind. Inhabits the north coast of Australia; Port Essington, Mr. Gilbert.

Description of No. A.C.3874, a male, probably adult, Whiteman Creek, near Grafton, N.S.W., 6.i.1948:

Habitus slender; total length of head and body 40 mm.; head triangular, rather acutely pointed, somewhat longer than broad (15.5 to 12 mm.); snout moderately long (7.5 mm.), nearly twice diameter of eye (4 mm.), pointed when viewed from above, torpedo-shaped in profile, projecting well beyond lower lip, which is directly below nostril; canthus rostralis straight, distinct but not prominent; lores slightly concave, sloping obliquely inwards and upwards from jaw to canthus rostralis; interorbital width twice that of an upper eyelid (4 to 2 mm.), sharply marked off between prominent eye bulges; internasal space 3.75 mm.; diameter of eye equals its distance from nostril; tympanum very distinct, within a white ring, directed slightly upward, contained in diameter of eye about 1.4 times (2.75 to 4 mm.), distance from eye 2 mm.; no distinct supratympanic fold.

Skin smooth but raised into a comparatively few large warts and prominent longitudinal folds; the two most prominent folds are dorsolateral and each runs from the eye to above the groin; two discontinuous folds start between the nostrils and run back on each side of the midline breaking up into a large number of warts at the posterior part of the back; warts on the upper parts of the sides, larger in front; upper eyelids warty; a glandular swelling from angle of jaws to above shoulder; chin, forepart of body, underside of forelimb, three quarters of thigh and rest of hindlimb smooth; belly, about half of posterior surfaces of thighs and small area of ventral surfaces of thighs rather finely granulate; no fold across breast; small anal flap.

Forelimb strong and moderately long (25 mm.), 63% of length of head and body; hand 11 mm.; finger discs small but distinct, rounded, not much more than one-third diameter of tympanum (1 to 2.75 mm.); fingers in order of length, 2, 1, 4, 3, the 1st

very slightly longer than 2nd; no trace of webbing; subarticular tubercles small, rounded, distinct; large, half-divided, outer metacarpal pad; large elongated tubercle on base of thumb, this is covered on inner side by a black nuptial pad which extends about two-thirds along the thumb to the single prominent subarticular tubercle; a flap-like fold above wrist.

Hindlimb elongated, slender but strong; length (77 mm.), 193% of head and body; femur 22 mm., tibia 23 mm., foot 32 mm.; heel reaches decidedly beyond tip of snout; toe discs hardly wider than toes, longer than wide, much smaller than tympanum (0.75 to 2.75 mm.); toes in order of length, 1, 2, 5, 3, 4; extent of webbing between toes, 67, 61, 58 and 45%; fringes of toes extremely narrow; subarticular tubercles small but distinct; no supernumerary tubercles; sole divided longitudinally; inner and outer metatarsal tubercles small but quite distinct, inner slightly the larger; pocket-like flaps at heels and ankles.

Vomerine elevations paired, rounded, well separated from each other and slightly more widely from the choanae, which are small; front of elevations in line with anterior margins of choanae, between which they are nearly wholly contained; tongue heart-shaped, free and shallowly grooved behind, a little more than half width of mouth at angle of jaws; large external subgular vocal sac, with two frills at each side and behind when deflated, and with a large opening into the mouth on each side of the tongue.

Dorsal colour very light brown to yellowish-white; a wide, black dorsolateral band begins after a gap behind the eye and peters out above the groin, its upper margin is even but it has irregular projections downwards; another black streak begins at the snout, runs through the eye and tympanum and dies out half-way along the side; a middorsal series of black blotches starts between the eyes and joins into two roughly marked out bands separated by a white line over the coccygeal region; ill-defined longitudinal black bands longitudinally along hindlimbs, the preaxial dorsal one marked out by a series of blotches, the median dorsal one along the thigh quite continuous; thighs behind uniform yellowish-white margined above by irregular, black marbling; the ventral surfaces almost uniform yellowish-white; a thin white line runs above the brownish edge of the upper jaw with projections dorsad before and behind the eye and ending in a white glandular fold behind and below the tympanum; three large white spots on each side below lower jaw.

Specimens examined and Locality Records: 1 (R.227, A.M.) 25 m. inland from Cairns, Q. (Cairn and Grant), Jan., 1888; 2 (R.1519, A.M.) Cooktown, Q. (D. le Souef), Dec., 1893; 1 (R.3530, A.M.) Mapoon, Gulf of Carpentaria, Q. (Charles Hedley), July, 1903; 1 (R.5010, A.M.) Cape York, Q. (Elgner, Chas. Hedley), Dec., 1910; 1 (R.6010, A.M.) Napier, Broome Bay, W.A.; 1 (R.6321, A.M.) Gurravembi, Nambucca River, N.S.W. (D. B. Fry and H. E. Smart), Oct., 1913; 2 (R.6952, A.M.) Cape Bedford, North Q. (Hedley and Briggs), Sept., 1916; 1 (R.7960, A.M.) Moa Island, Torres Strait, Q. (W. H. McClennan), Oct., 1922; 2 (R.8052-3, A.M.) Kiamari, Papua (A. R. McCulloch), 19.x.1922; 1 (R.9590, A.M.) Cape York, Q. (Mel Grafton), 1928; 5 (R.9731-2, A.M.) Groote Eylandt, North Aust. (H. E. Warren), 9.i.1929; 1 (R.10086, A.M.) Night Cliff, Pt. Darwin (Clark and Livingstone), Jan., 1930; 1 (R.11862, A.M.) no data; 4 (R.13208-13211, A.M.) Laloki Nursery, Port Moresby (L. Jones); 18 (R.13519-13523, R.13629-13631, A.M.) Groote Eylandt, North Aust. (John E. Bray); 1 (7017, A.M.) Warro, Port Curtis, Q.; 1 (7019, A.M.) Warro, Port Curtis, Q. (W. T. Blackman); 1 (7305, A.M.) no data; 10 (A.C.3867-76) Whiteman Creek, near Grafton, N.S.W., 6.i.1948; 1 (A.C.3897) Tooloom Falls, near Urbenville, N.S.W., 8.i.1948; 1 (A.C.5301) 25 m. S.E. of Wowan, Q., 11.i.1955; 3 (A.C.5321-3) near Childers, Q., 14.i.1955; 1 (R.3639, S.M.) Cairns, Q. (W. Hosmer), Oct., 1954; 3 (R.3824, S.M.) Shoal Bay, Rockhampton, Q. (J. Baldwin), 14.vi.1956; 2 (D.3284-5, N.M.) Randwick Swamp, N.S.W.; 1 (D.3289, N.M.) probably with preceding; 2 (D.3267-8, N.M.) Grafton, Clarence River, N.S.W.; 5 (U.S.N.M.128268-71, R.3253, S.M.) Umba Kumba, Groote Eylandt, N.T.; 1 (U.S.N.M.128459) Central Hill, Groote Eylandt, N.T.; 1 (U.S.N.M.128462) near Old Mission, Groote Eylandt, N.T., last three references vide Mitchell (1955: 405); 2 (M.C.Z.26001) near Darwin, N.T., vide

Loveridge (1949: 214); 3, Napier, Broome Bay, W.A. (G. F. Hill), vide Fry (1914: 210); 4 (M.C.Z.18138-41) Coen, Q., plus 6 Darwin, N.T., and Nambucca River, N.S.W., specimens, vide Loveridge (1935: 54); Yandina, Mount Tambourine, Alice River, Cape York, all Q., vide Andersson (1913: 25 and 1916: 15).

The 69 A.M., S.M., N.M. and A.C. specimens listed have all been examined.

Variation.—The head is longer than broad by 20-30%, generally about 22%. Often the snout is very acutely pointed. The ratio of the distance between the anterior corner of the eye and the tip of the snout to that between the anterior corners of the eyes averages 1.30 with an extreme case of A.C.3876 from Whiteman Creek with 1.50. Interorbital width may be as little as 1.25 or 1.5 times that of the upper eyelid as in two Burpengary frogs. The 1.4 ratio of eye to tympanum is very constant. A supratympanic fold is always present, becoming more conspicuous after long preservation. The tympanum with its raised rim is always very distinct. All specimens have prominent longitudinal folds, the median pair which are close together are often quite sharp. A swelling behind the angle of the jaws is invariably present as a conspicuous, white, glandular, almost lobe-like patch. The posterior margin of the vocal sac in males may develop into a fairly well marked fold. All males have this large external sac, and most a large black nuptial thumb shield. The thumb is more or less opposed. Length of the hindlimb to that of head and body is usually about 200% but may reach 220%. The proportion of webbing is rather constant. An inner metatarsal tubercle is always prominent. The outer one is small and rounded, but distinct. In a few cases it is prominent. Vomerine elevations may project slightly in front of the choanae. None extend behind, but in one of R.1519 they just reach a line joining the posterior borders of the choanae. Overall there is no great variation in coloration. The back may be almost plain, or have heavy black markings towards the sides, or again heavy longitudinal markings including the median area. The posterior surfaces of the thighs are yellowish. A dark longitudinal stripe always runs along the whole length of the thighs a little towards the dorsal margin. There is usually another stripe more ventrally and with a more dorsal one may form three longitudinal stripes. The median stripe sometimes has its borders very even or they may be wavy or even consist of a confluent series of round dots. The median stripe is beautifully marked in R.3639, S.M. among others, and sends prolongations to the more ventral stripe but not to the more dorsal one.

Discussion.—*Nasuta* is the most beautifully streamlined of all Australian *Hylids* with its pointed head, slender body and long legs. Krefft (1865: 19) believed *Litoria punctata* and *marmorata* were both "probably varieties of *nasuta*". He (p. 18) records *nasuta* from Sydney, and Günther (1867: 55) repeats his record. Fletcher, in about six references dealing mainly with distribution, questions this (1893a: 232 and 1894: 525) saying "*H. nasuta* would appear to have been confounded with *H. freycineti* (perhaps also with *H. latopalmata*) by Mr. Krefft, who reported it as a Sydney frog". I have always regarded the species as not coming southwards past the North Coast of New South Wales, but there are two specimens in the National Museum collected from the Randwick Swamp, Sydney, so, with Krefft's record, it is quite possible that stragglers did form colonies as far south as Sydney and have been wiped out by close settlement. Boulenger (1884: 415) recognized *nasuta*'s close relationship to *freycineti*, but separated it on the possession of "numerous longitudinal plaits on the back", elongation of hindlimb and toes, greater development of web, and coloration. Nieden (1923: 206) follows Boulenger closely. Andersson (1913: 25) remarked on the typical dark chestnut colour, and the fact that his Yandina specimen was not uniformly coloured dorsally but had "two light dorsolateral bands, diverging behind, and separating a light brown dorsal area from the dark chestnut sides". He also pointed out that *semoni* was probably identical with *nasuta*. There is no doubt that De Vis' *peninsulae* from Cape York is a synonym of *nasuta*. His description agrees exactly with *nasuta*, except for "outer metatarsal tubercle none", but this is often so small that it could easily have been missed. Loveridge (1949: 214) noted that in his Darwin specimens the tympanum was seven-eighths, or equal to, the orbital diameter and that the outer finger was without web. T. R. Tovell's field note is quoted "In life greenish-black with a broad brown stripe

down centre of back. Found among leaves after burning of spear grass at McMillan's, about six miles from Darwin". Noble (1931: 510) dealing with classification says "In the Australian regions, however, there are a few *Hylas* which resemble *Rana* even more closely than *Acris* does. *H. nasuta* of Queensland, in form, colour, dorsal folds, etc., is remarkably similar to *R. mascareniensis*. Further, its intercalary cartilages are greatly elongated as in *Acris*. It would seem that terrestrial life has called forth a greater development of these primarily arboreal structures". *Nasuta* is a lover of grassy swamps. Childers frogs were found in holes made by the hooves of cattle in a boggy stream flat. They are often seen at night hopping in wet grass. Males from Whiteman Creek were found at night sitting in shallow pools with their vocal sacs greatly distended. Live frogs often have bright colours which disappear on preservation. For instance A.C.3861 had a vermilion inguinal area and reddish-yellow behind the thighs.

HYLA FREYCINETI (Tschudi).

Synonymy and references: *Litoria freycineti*: Tschudi (1838: 36, 77); Duméril and Bibron (1841: 504); Günther (1858: 97); Steindachner (1867: 55). *Pelodytes affinis*: Gray (1842: 56), vide Günther (1858: 97). *Litoria mystacina*: Keferstein (1868a: 356). *Hyla* (*Litoria*) *Freycinetii*: Keferstein (1868a: 355; 1868b: 276). *Hyla* (*Litoria*) *Freycinetii*, var. *verruculata*: Keferstein (1868a: 355; 1868b: 277). *Hyla freycineti*: Boulenger (1882: 414); Fletcher (1889: 365, 371, 385; 1890: 671; 1893a: 232; 1894: 525, 530; 1898: 682, 684); Nieden (1923: 234); Loveridge (1935: 53).

Tschudi's original description (1838: 77) reads: 20. *Litoria* Tsch. Caput convexam, acutum, nares infra canthum rostralem; dentes palatinos perpaucos accumulatos; linguam crassam, integram, margine postico vix liberam, tympanum conspicuum; pedes tennes, digitos graciles vix apice dilatos, scellidum longissimos semipalmatos. Patria: Nova Hollandia. *Litoria Freycineti* Mus. Par.

The original description may almost be transferred to page 36 in the same work where Tschudi gives the generic diagnosis and mentions *freycineti*. He says: *Litoria* Tsch. Freycinet brachte diese Hyla aus Neuholland mit; in der Schädelbildung, der allgemeinen äussern Form und in der Gestalt der Füsse zeigt sie die auffallendsten Beziehungen zu *Strongylopus*; sie ist jedoch Hyla; die Gaumenzähne sind an der vordern Seite der innern Nasenöffnung angehäuft; die Zunge ist nicht sehr gross, aber dick; der Schädel gewölbt; das Trommelfell sichtbar; die Füsse schlank, die Zehen lang, vorn unbedeutend erweitert; die Hinterfüsse zur Hälfte mit einer Schwimmhaut verbunden.—*Litoria Freycineti*: tiefbraun auf hellbraunem Grunde; die Schenkel aber weiss gefleckt.

Description of No. R.4207, in the Australian Museum, an adult male, Maroubra Bay, Sydney, N.S.W., Sept., 1908 (Fry and Ross):

Habitus moderately stout but with long hindlimbs and a pointed head; total length of head and body (41 mm.); head subtriangular, somewhat longer than broad (16 × 14.5 mm.); snout moderate (8 mm.), 1.7 times diameter of eye (4.75 mm.), obtusely pointed when seen from above, in profile sloping steeply to a truncate beak, which extends well in advance of the lower lip, actual tip of snout pointed, the end of the snout is made more prominent by shallow grooves extending downwards from nostrils to upper lip; canthus rostralis angular; lores slightly concave; interorbital width equals that of an upper eyelid (3 mm.), eye bulges prominent; internasal width 4 mm.; diameter of the eye a shade more than its distance from nostril; tympanum very distinct, round, directed slightly upward, contained in diameter of eye 1.6 times (3 to 4.75 mm.), distance from eye 2 mm.; a distinct, straight supratympanic fold from eye to above shoulder.

Skin dorsally raised into numerous rounded warts, which are generally quite separate, very rarely confluent; there is a tendency for the warts to occur in six longitudinal series, this if anything is most pronounced in the two lines which begin well before the eyes and run back on each side of the vertebral line, at most the arrangement is very irregular; low rounded warts on femur and tibia; sides except upper

margins smooth; eyelids warty; chin and throat smooth; belly and undersides of thighs uniformly granulate; no fold across breast; a very small anal flap.

Forelimb fairly robust and rather short (23 mm.), 56% of length of head and body; hand 10 mm.; finger discs very small but distinct, rounded, hardly wider than fingers, one-third diameter of tympanum (1 to 3 mm.); fingers in order of length, 1=2, 4, 3; hand rather claw-like; fingers free of web; subarticular tubercles distinct, rounded; palmar area granular; thumb enlarged proximally, with brown nuptial elevation on inner side, somewhat opposed to fingers.

Hindlimb well developed; length (78 mm.) 190% of head and body; femur 21 mm., tibia 25 mm., foot 32 mm.; heel reaches well beyond tip of snout; toe discs very small, rounded, equal in size to those of fingers (1 mm.); toes in order of length, 1, 2, 3, 5, 4; extent of webbing between toes, 44, 38, 48 and 50%; all toes with very narrow fringes to discs; subarticular tubercles small, rounded, distinct; sole divided, smooth with a few small flat tubercles; inner metatarsal tubercle oval and prominent, outer less than half its size but distinct.

Vomerine elevations moderately developed, paired but closely opposed to form a transverse series, halved by line joining anterior margins of choanae, totally in front of line joining centres of choanae, which are rather small and elongated; tongue heart-shaped, free and nicked behind, practically width of mouth; large internal subgular vocal sac with a large opening into the mouth at each side of the tongue.

Dorsal colour light brown much obscured by black; three very irregular black stripes start from a patch which connects and covers both upper eyelids, the vertebral one is broken up above coccyx but continues to above vent, the two dorsolateral stripes continue almost to groins, the left one is disconnected; the black markings tend to be insuliform; a black streak from snout, through eye, to above shoulder; a large black patch on head; limbs dorsally barred and blotched with black; a few large white spots on brown behind thighs; light spots on lips; a light brown streak before and under eye to tympanum; chin and throat brown; belly and limbs yellow ventrally.

Specimens examined and Locality Records: 1 (R.181, A.M.) Paddington Reserve, Sydney, N.S.W. (H. Smithurst), Jan., 1888; 1 (R.3974, A.M.) Lindfield, Sydney, N.S.W. (Dene Fry); 1 (R.4187, A.M.) Lindfield, Sydney, N.S.W. (Dene Fry), Aug., 1908; 3 (R.4207, R.4213-4, A.M.) Maroubra Bay, Sydney, N.S.W. (Fry and Ross), Sept., 1908; 1 (R.4254, A.M.) Warrell Creek, Nambucca River, N.S.W. (Dene Fry), Nov., 1908; 1 (R.4332, A.M.) Lindfield, Sydney, N.S.W. (Dene Fry), Feb., 1909; 2 (R.4349, A.M.) Woodford, Blue Mts., N.S.W. (Dene Fry), 9.ii.1909; 1 (R.5104, A.M.) Botany, Sydney, N.S.W. (A. R. McCulloch); 1 (R.5687, A.M.) Lindfield, Sydney, N.S.W. (D. B. Fry), June, 1912; 1 (R.5689, A.M.) Lindfield, Sydney, N.S.W. (D. B. Fry), June, 1912; 2 (R.12316, A.M.) Far North Coast, N.S.W. (J. C. Wiburd); 2 (R.13421, A.M.) French's Forest, near Sydney, N.S.W. (R. MacKay), May, 1948; 2 (7007, 7009, A.M.) Warro, Port Curtis, Q.; 3 (7013-4, 7022, A.M.) Sydney; 1 (J.9530, Q.M.) Buderim Mts., Q.; 1 (D.8835, N.M.) Sydney, N.S.W.; 2 (M.C.Z.1936) Australia (Göttingen Mus.), 1885; 1 (M.C.Z.3604) Maroubra Swamps, Sydney, N.S.W. (Australian Mus.), 1914. Botany to Narrabeen, near Sydney, N.S.W. "Common about the swamps near the coast", vide Fletcher (1889: 385).

Variation.—Irregular wartiness is always present, distinct and characteristic, although the skin usually slips after long preservation and then the warts tend to disappear and the skin to appear smooth. The warts are rarely confluent, but they may be roughly arranged in longitudinal lines. Seven of the 15 Sydney frogs are extremely warty, but they are matched by the two R.12316 specimens from the Far North Coast. The vomerine elevations have always much the same relative position to the choanae, but are often not so strongly developed as in R.4207 and are generally distinctly separated. Proportions of the head remain much the same, and the snout is always acuminate. The dorsal colour is usually light or olive brown but may occasionally be grey. The blackish markings vary from a moderate punctulation to a near suppression of the ground colour. The large black patch between the eyelids, which nearly always joins them, is invariably present. Black cross-barring of the hindlimbs may be very

pronounced. Large whitish spots on brown behind the thighs are characteristic. In J.9530 from Queensland the head is rather longer than usual, its length/width proportion being 1.27 against 1.10 for R.4207. It is also somewhat slimmer although the proportions of the limbs are nearly identical. The interorbital width is 1.5 times that of an upper eyelid instead of equal. The back has a few, isolated, fairly large, low warts especially towards the sides and the eyelids are very warty. The vomerine elevations differ in being well separated, more rounded, and much smaller, being totally contained between lines joining the anterior margins and the centres of the choanae. The tongue is elongated and markedly narrower than the mouth.

Discussion.—This is probably the rarest and most restricted in range of the four species of the *lesueurii* complex. It is fairly distinctive and unlikely to be often confused with other species. Tschudi's original description (1838: 36, 77) in both Latin and German, although short, is reasonably diagnostic with its "*Litoria Freycineti*: tiefbraun auf hellbraunem Grunde, die Schenkel aber weiss gefleckt". Duméril and Bibron, who had at least one specimen from Port Jackson, noted that the fingers were united by a rudiment of web, and Keferstein (1868a: 355) also mentions a small web between the inner fingers. Keferstein both here and later (1868b: 276) probably includes *latopalmata* which had only just been described. Boulenger's excellent description (1882: 414) is closely followed by Nieden (1923: 234). Fletcher (see synonymy) refers to this species about 10 times in discussing breeding and other habits and distribution.

Bibliography.

- AHL, ERNST, 1935.—Beschreibung eines neuen Laubfrosches aus Südaustralien. *Zool. Anz.*, 109 (9-10): 252-3.
- ANDERSSON, LARS GABRIEL, 1913.—Results of Dr. E. Mjöberg's Swedish Scientific Expeditions to Australia, 1910-1913, Part 4, Batrachians. *K. svenska Vetensk. Akad. Handl.*, 52 (4): 1-26.
- , 1916.—Do., Part 9, Batrachians from Queensland. *Op. cit.*, 52 (9): 1-20.
- BARBOUR, T., 1914.—On some Australian Reptiles. *Proc. Biol. Soc. Washington*, 27: 201-206.
- BLANCHARD, FRANK N., 1929.—Re-Discovery of *Crinia tasmaniensis*, with Notes on this and other Tasmanian Frogs. *Aust. Zool.*, 5 (4): 324-328.
- BOETTGER, —, 1892.—Katalog der Batrachier-Sammlung. *Senck. Naturf. Gesell. Frankfurt*.
- BOULENGER, G. A., 1882.—Catalogue of the Batrachia Salientia s. ecaudata in the Collection of the British Museum, 2nd Ed., London.
- , 1885.—Remarks on Mr. C. W. De Vis's recent Contributions to the Herpetology of Australia. *Ann. Mag. Nat. Hist.*, (5) 16 (95): 386-387.
- , 1893.—Description of a new tree-frog from New South Wales. *Proc. Linn. Soc. N.S.W.*, 7 (3): 403.
- , 1920.—A Monograph of the South Asian, Papuan, Melanesian and Australian Frogs of the Genus *Rana*. *Rec. Ind. Mus.*: 1-226.
- BRIGGS, E. A., 1934.—*Anatomy of Animal Types*. Sydney.
- BUXTON, P. A., 1923.—*Animal Life in Deserts, A Study of the Fauna in Relation to Environment*. London. i-xv, 1-176.
- CHISHOLM, E. C., 1925.—The Principal Fauna of the Comboyne Plateau. *Aust. Zool.*, 4 (2): 54-74.
- , 1926.—Additional Fauna of the Comboyne Plateau. *Op. cit.*, 4 (5): 295-8.
- , 1929.—Further Additional Fauna of the Comboyne Plateau. *Op. cit.*, 5 (4): 333-336.
- COCHRAN, DORIS M., 1955.—Frogs of Southeastern Brazil. *U.S. Nat. Mus. Bull.*, 206: i-xvi, 1-423.
- COPE, EDWARD D., 1866.—On the Structure and Distribution of the Arciferous Anura. *Journ. Ac. Nat. Sci. Philad.*: 67-112.
- , 1867.—On the Families of the Raniform Anura. *Op. cit.*: 189-206.
- , 1869.—Seventh Contribution to the Herpetology of Tropical America. *P. Am. Phil. Soc.*: 147-169.
- COPLAND, STEPHEN J., 1945.—Catalogue of Reptiles in the Macleay Museum, 1. *Proc. Linn. Soc. N.S.W.*, 70 (5-6): 291-311.
- DAUDIN, F. M., 1803.—*Histoire naturelle des Rainettes, des Grenouilles et des Crapauds*. Paris.
- , 1802 (1803).—*Histoire naturelle, générale et particulière des Reptiles*. Paris.
- DAVIS, D. D., and GORE, U. R. 1936.—Clearing and staining skeletons of small Vertebrates. *Field Mus. Nat. Hist., Tech. Ser.*, 4: 1-15.
- DE VIS, CHARLES W., 1884a.—On some new Batrachians from Queensland. *Proc. Linn. Soc. N.S.W.*, 9 (1): 65-67.
- , 1884b.—On New Species of *Hyla*. *Proc. Roy. Soc. Qd.*, 1 (3): 128-130.

- DUMÉRI, AUGUSTE, 1853.—Mémoire sur les Batraciens anoures, de la famille des Hylaeiformes ou Rainettes. . . . *Ann. des Sci. nat.*, (3) 19: 135-179.
- , 1863.—Catalogue méthodique de la Collection des Batraciens du Muséum d'Histoire naturelle de Paris. *Mém. Soc. Sc. nat. Cherbourg*, 9.
- , 1865.—In *Nouv. Arch. Mus. d'Hist. Nat.*, bull., 1: 31-46 and 47-50.
- DUMÉRI, A. M. C., and BIERON, G., 1841.—*Erpétologie générale ou Histoire naturelle complète des Reptiles*. Paris. Vol. 8.
- DUNN, E. R., 1923.—The Geographical Distribution of Amphibians. *Amer. Nat. N.Y.*, 57 (649): 129-136.
- ENGLISH, SAVAGE, 1910.—Some Notes on Tasmanian Frogs. *Proc. Zool. Soc. London*, 627-634.
- FITZINGER, L. J., 1826.—*Neue Classification der Reptilien nach ihren natürlichen Verwandtschaften*. Wien.
- , 1843.—*Systema Reptilium*.
- , 1860.—*Sb. Ak. Wien*.
- FLEAY, D., 1935.—Frogs devour Snakes. *Vict. Nat.*, 52 (6): 122-123.
- FLETCHER, J. J., 1889.—Observations on the Oviposition and Habits of Certain Australian Batrachians. *Proc. Linn. Soc. N.S.W.*, 4 (2): 357-387.
- , 1890.—Contributions to a more exact knowledge of the Geographical Distribution of Australian Batrachia. 1. *Op. cit.*, 5 (4): 667-676.
- , 1891.—Do., 2. *Op. cit.*, 6 (2): 263-274.
- , 1892.—Do., 3. *Op. cit.*, 7 (1): 7-19.
- , 1894.—Do., 4. *Op. cit.*, 8 (4): 524-533.
- , 1898.—Do., 5. *Op. cit.*, 12 (4): 660-684.
- , 1893a.—Description of a New Cystignathoid Frog from New South Wales. *Op. cit.*, 8: 229-236.
- , 1893b.—Description of a New Cystignathoid Frog from New South Wales. *Op. cit.*, 8: 522-3.
- , 1901.—On the Rise and Early Progress of our Knowledge of the Australian Fauna. Presidential address. *A'sian Ass. Adv. Sci. Rep.*, 8: 69-104.
- FRY, DENE B., 1912.—Description of *Austrochaperina*, a new Genus of Engystomatidae from North Australia. *Rec. Aust. Mus.*, 9 (1): 87-106.
- , 1913a.—On a Varanus and a Frog from Burnett River. *Op. cit.*, 10: 17-34.
- , 1913b.—A Re-Examination of Macleay's New Guinea and Queensland Frog Types. *Mem. Qd. Mus.*, 2: 46-50.
- , 1914.—On a Collection of Reptiles and Batrachians from Western Australia. *Rec. W. Aust. Mus.*, 1 (3): 174-210.
- , 1915.—Herpetological Notes. *Proc. Roy. Soc. Qd.*, 27 (1): 60-95.
- GADOW, HANS, 1901.—Amphibia and Reptiles in the *Cambridge Natural History*. Vol. 8.
- GARMAN, SAMUEL, 1901.—Some Reptiles and Batrachians from Australasia. *Bull. Mus. comp. Zool. Harv.*, 39: 1-14.
- GIRARD, C., 1853.—Descriptions of new species of reptiles collected by the U.S. Exploring Expedition. *Proc. Acad. Nat. Sci. Philad.*, 6: 420-424.
- , 1859.—Herpetology in *U.S. Exploring Expedition under the command of Capt. Charles Wilkes*.
- GLAUERT, L., 1929.—Contributions to the Fauna of Rottneest Island. *J. Roy. Soc. W. Aust.*, 15: 43-45.
- , 1945.—Some Western Australian Frogs. *Aust. Mus. Mag.*, 8 (2): 379-382.
- , 1947.—Some unfortunate Errors in Collecting Localities. *W. Aust. Nat.*, 1 (2): 48.
- GRAY, JOHN EDWARD, 1841.—A Catalogue of the Species of Reptiles and Amphibia in *Grey's Journ. Exped. Discovery. West Australia*. 2.
- , 1842.—Description of some hitherto unrecorded species of Australian Reptiles and Batrachians. *Zool. Miscellany*, (3): 51-57.
- GÜNTHER, ALBERT, 1858.—*Catalogue of the Batrachia Salientia in the Collection of the British Museum*. London.
- , 1863a.—Observations of Australian Tree-Frogs living in the Society's Menagerie. *Proc. Zool. Soc. Lond.*, (2): 249-251.
- , 1863b.—On new Species of Batrachians from Australia. *Ann. Mag. Nat. Hist.*, (3) 11 (61): 26-28.
- , 1867.—Additions to the knowledge of Australian Reptiles and Fishes. *Op. cit.*, (3) 20 (115): 45-68.
- , 1870.—Second account of Species of Tailless Batrachians added to the collection of the British Museum. *Proc. Zool. Soc. Lond.*, 401-402.
- , 1897.—Description of New Species of Lizards and of a Tree-Frog from North-Eastern Queensland. *Novit. zool. Lond.*, 4, (3): 403-406.
- HARRISON, LAUNCELOT, 1922.—On the Breeding Habits of some Australian Frogs. *Aust. Zool.*, 3 (1): 17-34.
- INGER, ROBERT F., 1954.—Systematics and Zoogeography of Philippine Amphibia. *Fieldiana, Zoology*, 33 (4): 181-531.

- JACQUINOT and GUICHENOT, 1853.—In Dumont-D'Urville's *Voy. au Pôle Sud*, 26.
- KAMPEN, P. N. VAN, 1923.—*The Amphibia of the Indo-Australian Archipelago*. Leiden: 1-304.
- KEFERSTEIN, WILH., 1868a.—Beschreibung einiger neuen Batrachier aus Australien und Costarica. *Nachr. Göttingen*. (15) : 326-332; and Ueber einige neue oder seltene Batrachier aus Australien und dem tropischen Amerika: 341-361.
- , 1868b.—Ueber die Batrachier Australiens. *Archiv. für Naturg. Berlin*, 34 (1) : 253-290.
- KINGHORN, J. R., 1924.—Reptiles and Batrachians from South and South-West Australia. *Rec. Aust. Mus.*, 14 (3) : 163-183.
- , 1931.—Herpetological Notes. No. 2. *Op. cit.*, 18 (3) : 85-91.
- , 1932.—Herpetological Notes, No. 4. *Op. cit.*, 18 (7) : 355-363.
- , 1935.—Reptiles and Amphibians from Princess Charlotte Bay, North Queensland. *Rec. S. Aust. Mus.*, 5 (3) : 366.
- KREFFT, GERARD, 1864.—On the Batrachians occurring in the Neighbourhood of Sydney, with Remarks on their Geographical Distribution. *Proc. Zool. Soc. Lond.*: 386-390.
- , 1865.—The Frogs of Australia. *Pap. Proc. Roy. Soc. Tasm.*: 16-20.
- , 1866.—On the Vertebrated Animals of the Lower Murray and Darling, their Habits, Economy and Geographical Distribution. *Trans. Phil. Soc. N.S.W.*: 1-33.
- , 1869.—Notes on the Fauna of Tasmania. *Pap. Proc. Roy. Soc. Tasm.*: 83-105.
- LAMB, J., 1911.—Description of Three New Batrachians from Southern Queensland. *Ann. Qd. Mus.*, (10) : 26-28.
- LANKE, K., 1928.—Zur Biologie des Korallensingers. *Blätt. Aquar.-Kde.*, 39: 6-7.
- LESSON, R. P., 1830.—Zoologie in Duperrey's *Voy. . . . autour du Monde . . . sur . . . La Coquille*: 2.
- LIU, CH'ENG CHAO, 1947.—Two New Frogs of the Genus *Scutiger*. *Copeia*, No. 2: 123-126.
- LÖNNBERG, EINAR, 1900.—Reptiles and Amphibians collected in German New Guinea by the late Dr. Erik Nyman. *Ann. Mag. Nat. Hist.*, (7) 6 (36) : 574-582.
- LORD, C. E., and SCOTT, H. H. A., 1924.—*Synopsis of the Vertebrate Animals of Tasmania*. Hobart.
- LOVERIDGE, ARTHUR, 1934.—Tasmanian Amphibia in the Museum of Comparative Zoology, Cambridge, Massachusetts. *Pap. Roy. Soc. Tasm.*: 55-64.
- , 1935.—Australian Amphibia in the Museum of Comparative Zoology, Cambridge, Massachusetts. *Bull. Mus. Comp. Zool. Harv.*, 78 (1) : 1-62.
- , 1938.—On Some Reptiles and Amphibians from the Central Region of Australia. *Trans. Roy. Soc. S. Aust.*, 62: 183-191.
- , 1945a.—*Reptiles of the Pacific World*. New York, 1-259.
- , 1945b.—New Tree-Frogs of the Genera *Hyla* and *Nyctimystes* from New Guinea. *Proc. Biol. Soc. Washington*, 58: 53-58.
- , 1948.—New Guinea Reptiles and Amphibians in the Museum of Comparative Zoology and United States National Museum. *Bull. Mus. Comp. Zool. Harv.*, 101 (2) : 305-430.
- , 1949.—On some Reptiles and Amphibians from the Northern Territory. *Trans. Roy. Soc. S. Aust.*, 72 (2) : 208-215.
- , 1950.—New Frogs of the Genera *Cyclorana* and *Hyla* from Southeastern Australia. *Proc. Biol. Soc. Washington*, 63: 131-135.
- LUCAS, A. H. S., 1892.—Notes on the Distribution of Victorian Batrachians. *Proc. Roy. Soc. Vict.*, 4: 59-64.
- , 1896.—On Some Facts in the Geographical Distribution of Land and Fresh-Water Vertebrates in Victoria. *Op. cit.*, 9: 34-53.
- , 1901.—Two new species of Frogs from Victoria. *Op. cit.*, (2) 13: 175-178.
- and LE SOEUR, W. H. D., 1909.—*The Animals of Australia*. Amphibia: 259-297.
- LUTZ, BERTHA, 1954.—Anfibios Anuros do Distrito Federal. *Mem. Inst. Oswaldo Cruz*, 54 (1) : 155-238.
- MCCOY, F., 1867.—On the Recent Zoology and Palaeontology of Victoria. *Ann. Mag. Nat. Hist.*, (3) 20: 175-202.
- , 1885.—*Prodromus of the Zoology of Victoria*: 13-17.
- MACKEY, R. D., 1955.—Notes on a Collection of Reptiles and Amphibians from the Furneaux Islands, Bass Strait. *Aust. Zool.*, 12 (2) : 160-164.
- McKEOWN, K. C., 1943.—Vertebrates captured by Australian Spiders. (Reptiles and Amphibia: 23-26). *Proc. Roy. Zool. Soc. N.S.W.*: 17-30.
- MAIN, A. R., 1954a.—Key to the Frogs of South-Western Australia. *W. Aust. Nat.*, 4 (5) : 114-124.
- , 1954b.—Reports on Excursions. *Op. cit.*, 4 (7) : 170.
- MARRINER, 1907.—*Trans. N.Z. Inst.*
- MERREM, B., 1820.—*Versuch eines Systems der Amphibien*. Marburg.
- METCALF, M. M., 1923.—The Origin and Distribution of the Anura. *Amer. Nat. N.Y.*, 57 (652) : 385-411.
- MITCHELL, FRANCIS J., 1955.—Preliminary Account of the Reptilia and Amphibia collected by the National Geographical Society-Commonwealth Government-Smithsonian Institution Expedition to Arnhem Land. *Rec. S. Aust. Mus.*, 11 (4) : 373-408.

- MOORE, JOHN A., 1954.—Geographic and Genetic Isolation in Australian *Amphibia*. *Amer. Nat.*, 88 (839): 65-74.
- , 1956.—A Rejoinder to Rabb and Mosimann's Letter. *Op. cit.*, 90 (855): 390-392.
- NEILL, WILFRED T., 1954.—A New Species of Frog, Genus *Nyctimystes*, from Papua. *Copeia*, No. 2: 83-85.
- NIEDEN, FR., 1923.—*Das Tierreich*. 46. *Amphibia*, Anura 1: 1-584.
- NOBLE, G. K., 1922.—The Phylogeny of the Sallentia. 1. *Bull. Amer. Mus. Nat. Hist.*, 46 (1): 1-87.
- , 1924.—A New Spadefoot Toad from the Oligocene of Mongolia. *Amer. Mus. Novit.*, No. 132: 1-15.
- , 1931.—*Biology of the Amphibia*. New York: 1-577.
- Ogilby, J. Douglas, 1890.—Report on a Zoological Collection from British New Guinea, 1. *Rec. Aust. Mus.*, 1 (5): 89-104.
- , 1907.—A New Tree Frog from Brisbane. *Proc. Roy. Soc. Qd.*, 20: 31-32.
- PARKER, H. W., 1934.—A Monograph on the Frogs of the Family Microhylidae. *Brit. Mus. (Nat. Hist.) London*: 1-208.
- , 1938.—The races of the Australian frog *Hyla aurea* Lesson. *Ann. Mag. Nat. Hist.*, (11) 2 (9): 302-305.
- , 1940.—The Australasian frogs of the family Leptodactylidae. *Novit. Zool.*, 42: 1-106.
- PETERS, W., 1864a.—Ueber neue Amphibien. *Mber. Akad. Wiss. Berl.*: 271-276.
- , 1864b.—Ueber einige neue Amphibien. *Op. cit.*: 384-391.
- , 1866.—*Op. cit.*: 86-94.
- , 1870.—Machte eine Mittheilung über neue Saurier . . . und Batrachier. *Op. cit.*: 786-790.
- , 1875.—Las über neue Amphibien. *Op. cit.*: 616-624.
- PROCTER, JOAN B., 1924.—Unrecorded Characters seen in Living Snakes, and Description of a new Tree-Frog. *Proc. Zool. Soc. Lond.*, (4): 1125-1129.
- RABB, GEORGE B., and MOSIMANN, JAMES E., 1956.—Taxonomic Criteria in Australian Frogs. *Amer. Nat.*, 90 (855): 388-390.
- SCHNEIDER, I. G., 1799 (1801).—*Historiae Amphibiorum naturalis et literariae Fasciculus primus (secundus) continens*. Jena.
- SCOTT, E. O. G., 1942.—A New *Hyla* from Cradle Valley, Tasmania. *Rec. Queen Vict. Mus., Launceston*, 1 (1): 5-12.
- SEMON, 1894.—Boettger and Oudemans in *Zoologische Forschungsreisen in Australiens*.
- SHAW, G., 1802.—*General Zoology*, London, 3 (1).
- SPENCER, BALDWIN, 1892.—The Fauna and Zoological Relationships of Tasmania. *Australasian Assn. Adv. Sc.*, Hobart. Section D.: 1-44.
- , 1896.—*Amphibia in Zoology*, Part 2 of *Report of the Work of the Horn Scientific Expedition to Central Australia*, 152-175.
- , 1901.—Two New Species of Frogs from Victoria. *Proc. Roy. Soc. Vict.*, 13 (n.s.) 2: 175-178.
- STEINDACHNER, FRANZ, 1867.—*Amphibien*, in *Reise der österreichischen Fregatte Novara um die Erde*, Wien, 1: 1-70.
- TAYLOR, EDWARD H., 1948.—Two Hylid Frogs from Costa Rica. *Copeia*, No. 4: 233-238.
- , 1949.—A New Hylid Frog from Central Veracruz. *Op. cit.*, No. 4: 272-274.
- TSCHUDI, J. J., 1833.—Classification der Batrachier, mit Berücksichtigung der fossilen Thiere dieser Abtheilung der Reptilien. Neuchatel. Also 1839, *Mém. Soc. Neuchatel*, 2: 1-99.
- VAN KAMPEN, P. N., 1923.—*The Amphibia of the Indo-Australian Archipelago*, Leiden: 1-304.
- WAITE, E. R., 1929.—The Reptiles and Amphibians of South Australia. *Brit. Sci. Guild, Adelaide*: 1-270.
- WERNER, F., 1893.—Herpetologische Nova. *Zool. Anz.*, 16 (414): 81-84.
- , 1897.—Über einige noch unbeschriebene Reptilien und Batrachier. *Op. cit.*, 20 (537): 261-267.
- , 1897.—In *SB. Ak. München*: 216.
- , 1914.—*Amphibia*, in *Die Fauna Südwest-Australiens*, Jena, 4 (10): 403-426.
- WHITE, JOHN, 1790.—*Journal of a Voyage to New South Wales with Sixty-five Plates of Non-descript Animals, Birds, Lizards, Serpents, curious Cones of Trees and other Natural Productions*. London.
- WHITLEY, G. P., 1947.—The Fluvifaunulae of Australia. *W.A. Nat.*, 1 (3): 49-53.
- WRIGHT, ALBERT HAZEN, and WRIGHT, ANNA ALLEN, 1949.—*Handbook of Frogs and Toads of the United States and Canada*. New York: i-xii, 1-640.

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